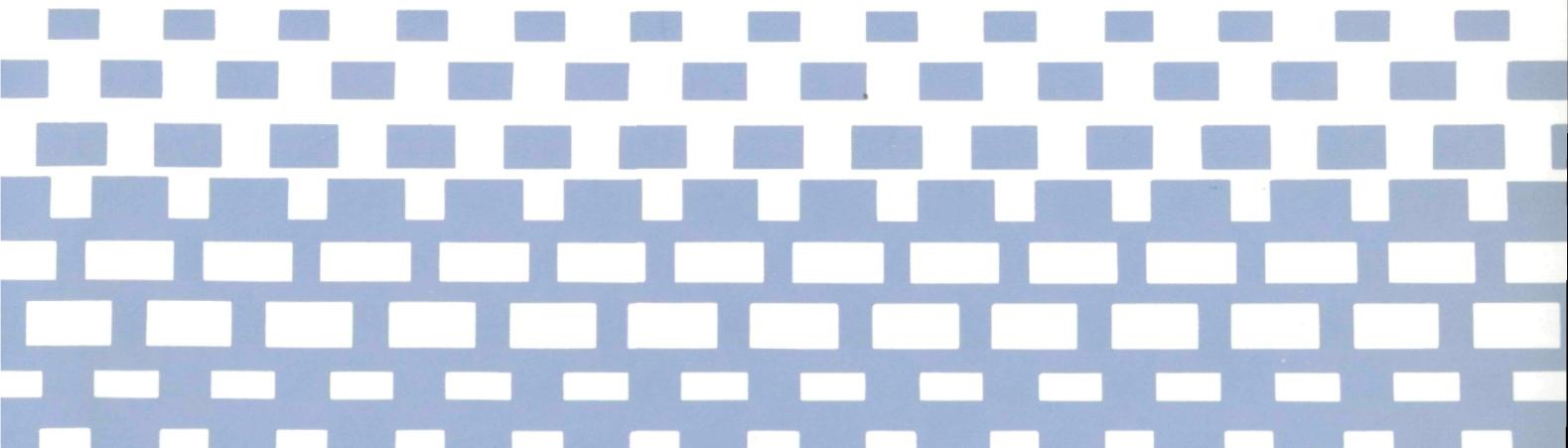


NASA SP-7011 (346)
February 1991

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



(NASA-SP-7011(346)) AEROSPACE MEDICINE AND
BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH
INDEXES (SUPPLEMENT 346) (NASA) 50 p

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NASA SP-7011 (346)
February 1991

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration
Office of Management
Scientific and Technical Information Program
Washington, DC

1991

INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 134 reports, articles and other documents originally announced in January 1991 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N91-10001 — N91-11665
IAA (A-10000 Series)	A91-10001 — A91-12944

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1991 will be published in early 1992.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

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TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED
ON MICROFICHE

ACCESSION NUMBER → N91-10591*# Good Samaritan Hospital and Medical Center, ← CORPORATE SOURCE
Portland, OR. Neurological Sciences Inst.
TITLE → ROLE OF ORIENTATION REFERENCE SELECTION IN ←
AUTHORS AND MOTION SICKNESS Semiannual Status Report
PUBLICATION DATE → ROBERT J. PETERKA and F. OWEN BLACK Sep. 1990 37 p
CONTRACT NUMBER → (Contract NAG9-117) ← AVAILABILITY SOURCE
REPORT NUMBERS → (NASA-CR-186612; NAS 1.26:186612) Avail: NTIS HC/MF A03 ← PRICE CODE
COSATI CODE → CSCL 06E

Three areas related to human orientation control are investigated:
(1) reflexes associated with the control of eye movements and posture;
(2) the perception of body rotation and position with respect to gravity;
and (3) the strategies used to resolve sensory conflict situations which arise when different sensory systems provide orientation cues which are not consistent with one another or with previous experience. Of particular interest is the possibility that a subject may be able to ignore an inaccurate sensory modality in favor of one or more other sensory modalities which do provide accurate orientation reference information. This process is referred as sensory selection. This proposal will attempt to quantify subject's sensory selection abilities and determine if this ability confers some immunity to the development of motion sickness symptoms.

Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

ACCESSION NUMBER → A91-12594* National Aeronautics and Space Administration. ← CORPORATE SOURCE
Ames Research Center, Moffett Field, CA.
TITLE → CREW SUPPORT FOR AN INITIAL MARS EXPEDITION ←
AUTHORS → YVONNE A. CLEARWATER (NASA, Ames Research Center, ← AUTHORS' AFFILIATION
Moffett Field, CA) and ALBERT A. HARRISON (California,
University, Davis) British Interplanetary Society, Journal (ISSN
0007-084X), vol. 43, Nov. 1990, p. 513-518. refs ← JOURNAL TITLE
Copyright ← PUBLICATION DATE

Mars crews will undergo prolonged periods of isolation and confinement, travel unprecedented distances from earth and be subjected to formidable combinations of hardships and dangers. Some of the biomedical, psychological and social challenges of the first manned Mars expedition are reviewed and means of aligning humans, technology and space habitats in the interests of mission success are identified.

Author

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 346)

FEBRUARY 1991

51

LIFE SCIENCES (GENERAL)

A91-10153*# National Aeronautics and Space Administration, Washington, DC.

LIFE SCIENCES AND MARS EXPLORATION

FRANK M. SULZMAN, JOHN D. RUMMEL (NASA, Washington, DC), LAUREN B. LEVETON, and RON TEETER (Lockheed Engineering and Sciences Co., Washington, DC) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 7 p. refs

(AIAA PAPER 90-3793) Copyright

The major life science considerations for Mars exploration missions are discussed. Radiation protection and countermeasures for zero gravity are discussed. Considerations of crew psychological health considerations and life support systems are addressed. Scientific opportunities presented by manned Mars missions are examined.

C.D.

A91-10215*# National Aeronautics and Space Administration, Washington, DC.

SPACE BIOLOGY IN THE 21ST CENTURY

THORA W. HALSTEAD and ROBERT W. KRAUSS (NASA, Washington, DC) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 7 p. refs

(AIAA PAPER 90-3886)

Space Biology is poised to make significant contributions to science in the next century. A carefully crafted, but largely ground-based, program in the United States has evolved major questions that require answers through experiments in space. Science, scientists, and the new long-term spacecrafts designed by NASA will be available for the first time to mount a serious Space Biology effort. The scientific challenge is of such importance that success will provide countless benefits to biologically dependent areas such as medicine, food, and commerce in the decades ahead. The international community is rapidly expanding its role in this field. The United States should generate the resources that will allow progress in Space Biology to match the recognized progress made in aeronautics and the other space sciences.

Author

A91-10218*# National Aeronautics and Space Administration, Washington, DC.

BIOLOGICAL RESEARCH ON SPACE STATION FREEDOM

L. P. CHAMBERS (NASA, Life Sciences Div., Washington, DC), P. D. STABEKIS, and R. C. TEETER (Lockheed Engineering and Sciences Co., Washington, DC) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 8 p. refs

(AIAA PAPER 90-3889) Copyright

The paper discusses laboratory capabilities of the SSF which permit long-term, systematic investigations into the effects of the space environment, particularly the effect of microgravity, on a range of biological specimens. The ability to manipulate gravity levels between 0 and 2.0 g makes it possible to examine

gravitational effects along a continuum. Space centrifuge research is expected to lead to practical applications in areas such as aging, treating malfunctions of the body regulatory and defense mechanisms, improving agricultural production, and extending human performance.

B.P.

A91-10219*# State Univ. of New York, Stony Brook.

BIOLOGICAL RESEARCH ON A SPACE STATION

A. D. KRIKORIAN (New York, State University, Stony Brook) and CATHERINE C. JOHNSON (NASA, Ames Research Center, Moffett Field, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 6 p. refs

(AIAA PAPER 90-3890) Copyright

A Space Station can provide reliable, long duration access to ug environments for basic and applied biological research. The uniqueness of access to near-weightless environments to probe fundamental questions of significance to gravitational and Space biologists can be exploited from many vantage points. Access to centrifuge facilities that can provide 1 g and hypo-g controls will permit identification of gravity-dependent or primary effects. Understanding secondary effects of the ug environment as well will allow a fuller exploitation of the Space environment. Author

A91-10850

CONTROL OF TOTAL PERIPHERAL RESISTANCE DURING HYPERTERMIA IN RATS

AKIRA TAKAMATA, HIROSHI NOSE, GARY W. MACK, and TAKETOSHI MORIMOTO (Kyoto Prefectural University of Medicine, Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 69, Sept. 1990, p. 1087-1092. refs

Copyright

The effect of blood volume modification on circulatory responses during progressive hyperthermia was studied using anesthetized rats. Rats anesthetized with Alpha chloralose were studied at three levels of blood volume: normovolemia (NBV), hypervolemia (HBV), and hypovolemia (LBV). Body surface heating was performed with an infrared lamp to raise arterial blood temperature at the rate of less than 0.1 C/min. Prior to heating, central venous pressure was significantly higher in HBV and lower in LBV than in NBV. The blood temperature at which CVP started to decrease was about 40 C in HBV, 41 C in NBV, and 42 C in LBV, and decreased by about 1.53, 1.92, and 0.62 mmHg from 37 to 43 C of the blood temperature in HBV, NBV, and LBV respectively. Results support the hypothesis that cardiopulmonary baroreflexes corresponding to a reduction in central venous pressure during progressive hyperthermia act to increase TPR and aid in the maintenance of mean arterial pressure. This cardiopulmonary baroreflex is also modified by the body temperature and the level of blood volume.

L.K.S.

A91-11113

A BANGIOPHYTE RED ALGA FROM THE PROTEROZOIC OF ARCTIC CANADA

NICHOLAS J. BUTTERFIELD, ANDREW H. KNOLL (Harvard University, Cambridge, MA), and KEENE SWETT (Iowa, University, Iowa City) Science (ISSN 0036-8075), vol. 250, Oct. 5, 1990, p. 104-107. Research supported by the National Geographic Society, NSF, and DOE. refs

Copyright

Silicified peritidal carbonate rocks of the 1250- to

51 LIFE SCIENCES (GENERAL)

750-million-year-old Hunting Formation, Somerset Island, arctic Canada, contain fossils of well-preserved bangiophyte red algae. Morphological details, especially the presence of multiserial filaments composed of radially arranged wedge-shaped cells derived by longitudinal divisions from disk-shaped cells in uniseriate filaments, indicate that the fossils are related to extant species in the genus Bangia. Such taxonomic resolution distinguishes these fossils from other pre-Edicaran eukaryotes and contributes to growing evidence that multicellular algae diversified well before the Edicaran radiation of large animals. Author

A91-11377

METABOLISM OF PHOSPHORUS-CONTAINING COMPOUNDS IN THE LIVER OF LONG-TAILED GROUND SQUIRRELS (*CITELLUS UNDULATUS*) IN VARIOUS PHYSIOLOGICAL STATES [METABOLIZM FOSFOROSODERZHASHCHIKH SOEDINENII V PECHENI DLINNOOKHOSTYKH SUSLIKOV /*CITELLUS UNDULATUS*/ PRI RAZLICHNYKH FIZIOLOGICHESKIKH SOSTOIANIIAKH]

V. I. GRISHCHENKO, A. M. BELOUS, V. A. MOISEEV, V. I. ZAGNOIKO, V. D. ZINCHEŃKO (AN USSR, Institut Problem Kriobiologii i Kriomeditsiny, Kharkov; AN USSR, Institut Kolloidnoi Khimii i Khimii Vody, Kiev, Ukrainian SSR) et al. Akademii Nauk SSSR, Doklady (ISSN 0002-3264), vol. 312, no. 4, 1990, p. 996-999. In Russian. refs

Copyright

A91-11919

SENSITIVITY TO STEROIDS AND STEROID-BINDING SITES OF THE THERMOACIDOPHILIC ARCHAEBACTERIUM *SULFOLOBUS ACIDOCALDARIUS* [CHUVSTVITEĽ'NOST' K STEROIDAM I STEROIDSVIAZYVAIUSHCHIE ZONY TERMOATSIDOFIL'NOI ARKHEBAKTERII *SULFOLOBUS ACIDOCALDARIUS*]

G. D. MUSKHELISHVILI, M. V. KARSELADZE, and D. A. PRANGISHVILI (AN GSSR, Institut Molekuliarnoi Biologii i Biologicheskoi Fiziki, Tbilisi, Georgian SSR) Akademii Nauk SSSR, Doklady (ISSN 0002-3264), vol. 313, no. 5, 1990, p. 1259-1262. In Russian. refs

Copyright

A91-11924* Wright State Univ., Dayton, OH.

EFFECTS OF SEROTONIN ANTAGONISTS ON MOTION SICKNESS AND ITS SUPPRESSION BY 8-OH-DPAT IN CATS JAMES B. LUCOT (Wright State University, Dayton, OH) Pharmacology, Biochemistry and Behavior (ISSN 0091-3057), vol. 37, 1990, p. 283-287. refs
(Contract NCC2-229)

Copyright

The antagonist properties of (-)propranolol, (+)propranolol, metergoline and BMY 7378 on the known effect of 8-OH-DPAT (DPAT) to decrease motion sickness in cats has been evaluated. (-)Propranolol produced a greater decrease in the antiemetic effect of DPAT than did (+)propranolol. Although metergoline produced a decrease in the antiemetic effect of DPAT, the decrease could not be clearly attributed to interactions with 5-HT(1A) receptors because metergoline alone slightly enhanced motion sickness. Depletion of 5-HT with PCPA produced a weaker, nonsignificant enhancement of motion sickness, while mesulergine had no effect. As neither nonspecific 5-HT receptor blockade with metergoline nor depletion of 5-HT mimicked the antiemetic effect of DPAT, it was concluded that DPAT acts on postsynaptic 5-HT(1A) receptors to prevent emesis. BMY 7378 alone decreased the incidence of motion sickness. A dose just below this agonist range did not decrease the effects of DPAT. Author

A91-11975

ENDOGENOUS OPIOID MECHANISMS IN THE REGULATION OF PAIN SENSITIVITY AND BEHAVIORAL REACTIVITY IN CONNECTION WITH ADVERSE STATES OF DIFFERENT NATURE [ENDOGENNYE OPIOIDNYE MEKHANIZMY V REGULIATSII BOLEVOI]

CHUVSTVITEĽ'NOSTI-POVEDENCHESKOI REAKTIVNOSTI PRI AVERSIVNYKH SOSTOIANIIAKH RAZLICHNOI PRIRODY] E. A. KIATKIN (AMN SSSR, Institut Farmakologii, Moscow, USSR) Akademii Nauk SSSR, Izvestia, Seria Biologicheskai (ISSN 0002-3329), Sept.-Oct. 1990, p. 778-781. In Russian. refs Copyright

The effects of an opiate receptor naloxone on the thresholds of reactions to acute pain (i.e., the threshold of vocal response and the latent period of the motile reaction) were investigated in rats divided into groups of freely moving rats (controls) rats subjected to i.p. injections of an algogene (0.5 percent acetic acid, 50 mg/kg body weight), and rats subjected to immobilization stress or to a somatic trauma (leg injury). It was found that naloxone injections inhibited vocal and motile reactions to algogene i.p. injections but did not significantly affect reactions of animals in two other stress situations, indicating that opioid peptides played an important role in establishing endogenous analgesia during visceral pain stimulation. I.S.

A91-12042

REGULATION OF TIDAL VOLUME IN RATS UNDER HYPOXIA AND HYPERCAPNIA USING INSTRUMENTAL FEEDBACK [UPRAVLENIE DYKHATEĽ'NYM OB'EMOM POSREDSTVOM INSTRUMENTAL'NOI OBRATNOI SVIAZI V USLOVIIAKH GIPOKSII I GIPERKAPNII Y KRYS]

V. I. MINIAEV and S. A. GRABEL'NIKOV (Kalininskii Gosudarstvennyi Universitet, Kalinin, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, May 1990, p. 621-626. In Russian. refs Copyright

A91-12043

MECHANISMS OF EXTERNAL-RESPIRATION DISORDERS IN HYPOXIA [MEKHANIZMY NARUSHENIIA VNESHNEGO DYKHANIJA PRI GIPOKSII]

V. P. POZHAROV and M. M. SEREDENKO (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, May 1990, p. 678-684. In Russian. refs

Copyright

The characteristics of breathing patterns in anesthetized rats inhaling hypoxic (from 6 to 16 percent oxygen content) gas mixtures were investigated. It was found that, at the lowest oxygen concentration, the development of hypoxia in lung tissues and the activation of lipid oxidation in these tissues led to a sharp increase of elastic-tissue resistance to breathing motions, causing a decrease in tidal volume not compensated by an increase of the respiration rate. The mechanisms responsible for the disruption of breathing patterns during hypoxia and other types of stress are identified. I.S.

A91-12151#

LIFE SUPPORT BY-PRODUCTS

CARL N. HODGES (Arizona, University, Tucson) IN: Space mining and manufacturing; Proceedings of the First Annual Invitational Symposium, Tucson, AZ, Oct. 24-26, 1989. Tucson, AZ, NASA Space Engineering Research Center for Utilization of Local Planetary Resources, 1989, p. VIII-1 to VIII-5.

The results of the Biosphere I experiment are briefly discussed. Plans for Biosphere II and the Solar Oasis in Arizona are addressed. Technological spinoffs from these efforts are mentioned. C.D.

A91-12153#

BIOSPHERE II - A PROJECT FOR THE STUDY OF BIOSPHERICS ON EARTH AND SPACE

MARK NELSON (Space Biospheres Ventures, Oracle, AZ) IN: Space mining and manufacturing; Proceedings of the First Annual

Invitational Symposium, Tucson, AZ, Oct. 24-26, 1989. Tucson, AZ, NASA Space Engineering Research Center for Utilization of Local Planetary Resources, 1989, p. VIII-30 to VIII-44. refs

The Biosphere II project aims to create and operate a 3.15-acre prototype space life systems facility. Such bioregenerative systems are an important scientific constraint to the ability to extend human and earth life permanently into space. Biosphere II will be the first major ground-based testbed for research into such biospheric systems. Research at the project's Biospheric Research and Development Center is looking at major systems such as waste recycling, food production, air purification, and the development of technologies compatible with closed ecological systems. The Biosphere II Test Module, which has conducted life system research since 1986, is the largest closed life system facility ever constructed, and the first to do total air, water, and waste recycling and food production with human participants.

Author

N91-10551# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

6 Jan. 1990 80 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-90-001) Avail: NTIS HC/MF A05

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, agriculture, biochemistry, biophysics, epidemiology, genetics, immunology, industrial medicine, laser bioeffects, medicine, nonionizing radiation effects, pharmacology and toxicology, physiology, public health, radiobiology, veterinary medicine, and virology.

M.G.

N91-10552# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

26 Jul. 1990 40 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-90-013) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, agriculture, biochemistry, biotechnology, epidemiology, genetics, immunology, laser bioeffects, medicine, microbiology, molecular biology, nonionizing radiation effects, pharmacology and toxicology, physiology, public health, radiobiology, and virology.

N91-10553# Joint Publications Research Service, Arlington, VA.
MORPHOLOGICAL EXAMINATION OF RAT ADRENAL GLANDS FOLLOWING FLIGHT ABOARD BIOSPUTNIK KOSMOS-1667 Abstract Only

N. G. PRODAN and V. BARANSKA *In its JPRS Report: Science and Technology. USSR: Life Sciences p 2* 26 Jul. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 6, Nov. - Dec. 1989 p 27-30

Avail: NTIS HC/MF A03

Histological examinations were performed on the adrenal glands of seven male Wistar rats after a 7-days flight aboard biosatellite Cosmos-1667. The studies were conducted 4 to 6 hours after landing to assess the effects of weightlessness. The weight of the glands and the volume of cortical and medullary tissue were not affected. The general architectonics of the glands were within normal limits, although the width of the zona glomerulosa was somewhat narrowed. In the zona glomerulosa the nuclei:cytoplasm ratio remained normal, although the cytoplasm and nuclear volumes in the experimental animals were expanded. The ratio was increased in the zona fasciculata due to an increase in the nuclear volume. The zona reticularis remained unaffected. The entire cortex was hyperemic, while the presence of numerous cytoplasmic vacuoles indicated lipid depletion. Increased vacuolization of medullary cells and diminished area of epinephrine- and norepinephrine-producing cells were interpreted to reflect gravitational stress. The findings suggested diminished medullary function and attenuation of the sympathetic system during space flight.

Author

N91-10556# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

16 Jul. 1990 48 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-90-012) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, biochemistry, epidemiology, immunology, medicine, military medicine, molecular biology, pharmacology and toxicology, physiology, and public health.

N91-10562# Joint Publications Research Service, Arlington, VA.
EFFECTS OF TAURINE ON CYTOGENETIC CORNEAL DISTURBANCES INDUCED IN MICE BY 9 GEV PROTONS Abstract Only

S. V. VOROZHTSOVA and YE. I. YARTSEV *In its JPRS Report: Science and Technology. USSR: Life Sciences p 2* 16 Jul. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Moscow, USSR), v. 23, no. 3, May - Jun. 1989 p 86-89

Avail: NTIS HC/MF A03

The fact that protons account for some 80 percent of cosmic radiation led to a more detailed analysis on the efficiency of taurine drops on mitigating proton-induced cytogenetic damage to the cornea. The experiments were performed with mice irradiated with 9 GeV protons in doses ranging from 0.25 to 7.0 Gy. Certain animals were treated with 2 drops of 4 percent taurine solution in each eye five times before or after irradiation. Corneal monitoring at 24 and 72 hours demonstrated that proton irradiation led to a reduction in mitotic activity, an increase in the number of cells with chromosomal abnormalities, and cell depletion. These changes were essentially dose-dependent. Treatment with taurine reduced the number of cells with chromosomal abnormalities by two- to fivefold and was effective when administered both before and after irradiation. The effects of taurine were attributed to the fact that it had an inhibitory effect on mitosis, limiting thereby the extent of primary radiation damage and, consequently, postirradiation damage to the genome.

Author

N91-10565# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

11 Jul. 1990 18 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-90-011) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, epidemiology, pharmacology and toxicology, and public health.

N91-10568# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

A. P. DMITRIYEV 2 Jul. 1990 74 p

(JPRS-ULS-90-010) Avail: NTIS HC/MF A04

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: agriculture, biochemistry, biophysics, biotechnology, epidemiology, immunology, laser bioeffects, microbiology, pharmacology and toxicology, physiology, public health, and veterinary medicine.

M.G.

N91-10569# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

A. N. PALILOVA 9 Jul. 1990 79 p

(JPRS-ULS-90-009) Avail: NTIS HC/MF A05

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: biophysics, epidemiology, genetics, medicine, molecular biology, physiology, and public health.

M.G.

51 LIFE SCIENCES (GENERAL)

N91-10570# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

YE. A. KOVALENKO 27 Jun. 1990 82 p
(JPRS-ULS-90-008) Avail: NTIS HC/MF A05

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, agriculture, biochemistry, epidemiology, genetics, laser bioeffects, microbiology, pharmacology and toxicology, physiology, radiobiology, and public health. M.G.

N91-10571# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

A. V. OVSYANNIKOV 18 Jun. 1990 56 p
(JPRS-ULS-90-006) Avail: NTIS HC/MF A04

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: agriculture, biochemistry, biotechnology, immunology, laser bioeffects, microbiology, pharmacology and toxicology, physiology, public health, radiobiology, veterinary medicine, and virology. M.G.

N91-10572# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

14 Jun. 1990 40 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-90-005) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, biochemistry, epidemiology, genetics, immunology, industrial medicine, laser bioeffects, medicine, microbiology, military medicine, nonionizing radiation effects, pharmacology and toxicology, physiology, and virology. M.G.

N91-10573# Pacific Northwest Lab., Richland, WA.
ELF (EXTREMELY-LOW-FREQUENCY): EXPOSURE LEVELS, BIOEFFECTS, AND EPIDEMIOLOGY

LARRY E. ANDERSON Jun. 1990 18 p Presented at the 1990 Health Physics Society Meeting, Anaheim, CA, 18-22 Jun. 1990

(Contract DE-AC06-76RL-01830)
(DE90-016554; PNL-SA-18314; CONF-900679-7) Avail: NTIS HC/MF A03

Extremely-low-frequency (ELF) electromagnetic fields arise from a variety of sources including power distribution networks, public transportation systems, electrical appliances and motors, electrically heated beds and blankets, etc. In fact, in an industrialized society, people and animals are bathed in complex milieu of elevated electromagnetic fields. The ways in which exposure to these ELF electric and magnetic fields may affect biological systems are not obvious. Ionizing radiation can interact with neutral molecules to form chemically reactive radical or ionic species; however, ELF radiation transfers energy to tissues at a level lower than is already present in the form of thermal energy. ELF electromagnetic fields, nonetheless, appear to interact with tissue, and in particular with neural tissue in some whole-animal and cellular systems. This paper evaluates possible interactions between the contemporary electromagnetic environment and living organisms, and whether such influences are temporary or long lasting, beneficial or harmful. In studies on electric and magnetic fields, a broad range of exposure levels has been employed from a few volts/meter to more than 100 kV/m, and from 0.01 to 30 millitesla. A equally wide span of biological endpoints have been evaluated for possible response to ELF fields. DOE

N91-11351# Los Alamos National Lab., NM. Complex Systems Group.

OSCILLATION ONSET IN NEURAL DELAYED FEEDBACK

ANDRE LONGTIN Nov. 1990 7 p Presented at the IEEE Conference on Neural Information Processing: Natural and Synthetic, Denver, CO, 26-29 Nov. 1990

(Contract DE-W-7405-ENG-36)
(DE90-015057; LA-UR-90-2562; CONF-901150-2) Avail: NTIS HC/MF A02

This paper studies dynamical aspects of neural systems with delayed negative feedback modelled by nonlinear delay-differential equations. These systems undergo a Hopf bifurcation from a stable fixed point to a limit cycle oscillation as certain parameters are varied. We show that their frequency of oscillation is robust to parameter variations and noisy fluctuations, a property that makes these systems good candidates for pacemakers. The onset of oscillation is postponed by both additive and parametric noise in the sense that the state variable spends more time near the fixed point. Finally, we show that a distributed delay (rather than a fixed delay) also stabilizes the fixed point solution. DOE

N91-11352# Argonne National Lab., IL. Biological and Medical Research Div.

PROTECTION BY WR-2721 AND WR-151327 AGAINST LATE EFFECTS OF GAMMA RAYS AND NEUTRONS

D. J. GRDINA, B. A. CARNES, and B. NAGY 1990 7 p Presented at the 28th COSPAR Plenary Conference, The Hague, Netherlands, 25 Jun. - 6 Jul. 1990
(Contract W-31-109-ENG-38)
(DE90-017792; CONF-9006220-4) Avail: NTIS HC A02/MF A01

Two thiophosphoroate compounds WR-2721 and WR-151327 were assessed for their ability to modify the deleterious effects (life shortening and carcinogenesis) of fission-spectrum neutrons or gamma rays on B6CF1 hybrid mice. Male and female mice were irradiated individually at 110 days of age. Radioprotectors were administered intraperitoneally 30 min prior to irradiation. Animals were housed five to a cage; cage locations in the holding rooms were randomized by computer. Animals were checked daily and all deceased animals were necropsied. WR-2721 afforded protection against both neutron- and gamma-ray-induced carcinogenesis and subsequent life shortening. Cumulative survival curves for unirradiated mice of either sex were unaffected by protectors. DOE

N91-11353# Argonne National Lab., IL.
THE STRUCTURE AND FUNCTION OF MEMBRANE PROTEIN PHOTOSYNTHETIC REACTION CENTER

CHONG-HWAN CHANG, D. TIEDE, J. NORRIS, and M. SCHIFFER 1990 5 p Presented at the 11th International Science and Technology Symposium, Seoul, Republic of Korea, 25-29 Jun. 1990
(Contract W-31-109-ENG-38)
(DE90-017795; CONF-9006194-2) Avail: NTIS HC/MF A01

The three dimensional structure of the photosynthetic reaction center from Rhodobacter (Rb.) sphaeroides has been determined using x ray diffraction technique. It has 11 membrane spanning helices, five each from the L and M subunit and one from the H subunit. There is a pseudo-twofold symmetry between the L and M subunits and their amino acid sequences have some similarity. The pigment components, which are located at the hydrophobic core of the reaction center also have this symmetry. We confirmed that two bacteriochlorophylls have a predicted conformation called a special pair. The nonheme iron is liganded with four histidines and one glutamic acid. DOE

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Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A91-10163*# Washington State Univ., Pullman.

HUMAN SKELETAL MUSCLE RESPONSES TO SPACEFLIGHT AND POSSIBLE COUNTERMEASURES

PHILIP D. GOLLNICK (Washington State University, Pullman), V.

REGGIE EDGERTON (California, University, Los Angeles), and BENGT SALTIN (Copenhagen University, Denmark) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 7 p. refs
 (Contract NAG9-363)
 (AIAA PAPER 90-3809) Copyright

The current status of knowledge concerning the effects of unweighting skeletal muscle is summarized. The results of both ground-based and space-based animal studies are reviewed which show that there is rapid loss in muscle mass, primarily in slow-twitch muscle, of the rat during unweighting of muscle. There is also a shift in the myosin isoforms with muscles such that slow-twitch muscles take on many of the characteristics of fast-twitch muscles. Ground-based studies in human suggest that programs of electrical stimulation can be developed to simulate normal muscular contractions. Attempts to develop countermeasures to the adverse effects of space travel on muscular functions in humans have not been successful to date.

C.D.

A91-10164#
CARDIOVASCULAR ADAPTATION TO SPACE FLIGHT
 THOMAS N. JAMES (Texas, University, Galveston) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 13 p.
 (AIAA PAPER 90-3810) Copyright

Normal cardiovascular function on earth is compared to cardiovascular adaptation and functioning in space. The factors which normally modulate cardiac and vascular function are examined, and it is shown how microgravity impacts those factors and functions. Technologies which compensate for these changes are discussed.

C.D.

A91-10165# New York Univ. Medical Center.
NEURONAL PLASTICITY IN RELATION TO LONG-DURATION SPACEFLIGHT
 DEAN E. HILLMAN (New York University, Medical Center) and JAMES W. WOLFE (Texas, University, San Antonio) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 11 p. refs
 (Contract NIH-NS-20349; NAGW-1867)
 (AIAA PAPER 90-3811) Copyright

Exposure to microgravity leads to a marked reduction in sensory-motor stimuli to the vestibular, proprioceptive and somatosensory systems. Long-duration missions, such as those proposed for a trip to Mars, may lead to significant changes in neural function. This paper presents results based on studies of sensory deafferentation of specific brain regions and detailed changes which occur in neuronal architecture. Data from these studies emphasize the need for further research related to sensory system deprivation and the development of new unique countermeasures for long-duration space flight.

Author

A91-10166# National Aeronautics and Space Administration, Washington, DC.
PHYSIOLOGICAL ADAPTATION TO SPACE FLIGHT
 ARNAULD E. NICOGOSSIAN, FRANK M. SULZMAN (NASA, Washington, DC), KAREN K. GAISER, and RONALD C. TEETER (Lockheed Engineering and Sciences Co., Washington, DC) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 7 p. refs
 (AIAA PAPER 90-3813) Copyright

In space, adaptive physiological changes have been observed in virtually all body systems, but how far these changes progress with time is not known. Their time course demonstrates variable patterns; some systems show evidence of gradual and progressive change. Biomedical postflight data have shown that a compensatory period of readaptation to one gravity is required after space flight, with longer intervals required for longer missions. Consistent readadaptation trends include orthostatic intolerance and neurovestibular difficulties. For the long-duration missions of the exploration era, it is critical to determine the extent to which deleterious changes (e.g., bone loss and possible immunological changes) can be reversed upon return to earth. Radiation protection

is another critical enabling element for missions beyond low earth orbit. Radiation exposure guidelines have not been established for exploration missions. Currently our experience is insufficient to prescribe countermeasures for the stay times associated with a lunar base or a mission to Mars. Artificial gravity may provide a solution, but the level and duration of exposure necessary to prevent deconditioning must be determined. Central issues for medical care in remote settings are preventive, diagnostic, and therapeutic care and the minimization of risk.

Author

A91-10848
CEREBRAL OXYGEN AVAILABILITY BY NIR SPECTROSCOPY DURING TRANSIENT HYPOXIA IN HUMANS

N. B. HAMPSON, E. M. CAMPORESI, B. W. STOLP, R. E. MOON, J. E. SHOOK (Duke University, Medical Center and Hypo-Hyperbaric Center, Durham, NC) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 69, Sept. 1990, p. 907-913. refs

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NIR (near infrared) spectroscopy was used to study the effects of mild hypoxia on brain oxyhemoglobin, cytochrome a,a3 redox status, and cerebral blood volume in eight volunteers. Incremental hypoxia reaching 70 percent arterial O₂ saturation was produced in normocapnia or hypocapnia by an 8 min rebreathing technique and regulation of inspired CO₂. Normocapnic hypoxia resulted in increases in heart rate by 35 percent, increases in systolic blood pressure by 14 percent, and a fivefold increase in minute ventilation, while hypocapnic hypoxia resulted in a steady decline of cerebral oxyhemoglobin content and a decrease in oxidized cytochrome a,a3. In the brain, hypoxia resulted in a steady decline of cerebral oxyhemoglobin content and a decrease in oxidized cytochrome a,a3. It is concluded that cytochrome a,a3 oxidation level in vivo decreases at mild levels of hypoxia and that Pa(CO₂) is an important determinant of brain oxygenation because it modulates ventilatory, cardiovascular, and cerebral O₂ delivery responses to hypoxia.

L.K.S.

A91-10849
HUMAN DOSE-RESPONSE RELATIONSHIP FOR DECOMPRESSION AND ENDOGENOUS BUBBLE FORMATION
 RODERIC G. ECKENHOFF, CHRISTOPHER S. OLSTAD, and GEORGE CARROD (Pennsylvania, University, Medical Center, Philadelphia; Marine Resources Development Foundation, Key Largo, FL) Journal of Applied Physiology (ISSN 0161-7567), vol. 69, Sept. 1990, p. 914-918. Research supported by NOAA. refs
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The dose-response relationship for decompression magnitude and venous gas emboli (VGE) formation in humans was investigated by conducting pressure exposures of 138, 150, and 164 kPa in an underwater habitat for 48 hours. One-hundred-eleven volunteers surfaced in less than five minutes and were monitored for VGE with a continuous wave Doppler ultrasound device over the precordium or subclavian veins at regular intervals for a 24-hour period. An analysis of this and previously reported data is conducted and it is concluded that the reduction in pressure necessary to produce bubbles in humans is much less than was previously thought; 50 percent of humans can be expected to generate endogenous bubbles after decompression from a steady-state pressure exposure of only 135 kPa, or 11 ft of seawater. This not only has implications for decompression schedule formulation, but also for altitude exposures. The study suggests that bubbles should form in humans after altitudes of less than 5000 m.

L.K.S.

A91-11424
INFLUENCE OF BODY MASS ON THE ARTERIAL PRESSURE AND BLOOD LIPIDS IN FLIGHT PERSONNEL [ZAVISIMOST' UROVNIA ARTERIAL'NOGO DAVLENIIA, LIPIDOV KROVI OT MASSY TELA U LITS LETNOGO SOSTAVA]

E. G. MUKHAMEDOV, L. P. PUKACH, V. F. KEMENCHEDZHI, O. K. ANISIMOVA, and E. A. PAPISH Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), June 1990, p. 58, 59. In Russian.

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Various blood-pressure parameters and the levels of cholesterol, triglycerides, beta-lipoproteines, and sugar in blood were correlated

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with the value of body mass index of flight personnel in the age range 21-52. It is shown that, with an increase in body mass, all parameters of arterial pressure (systolic and diastolic pressures and the mean dynamic pressure) increased in a stepwise fashion, with pressure parameters remaining constant for the body mass index ranges 19-22, 23-28, and 29-30 kg/sq m. Similar stepwise increases with increasing body weight index were observed for blood lipids and blood sugar. I.S.

A91-11425

ASSESSMENT OF CARDIORESPIRATORY FUNCTIONS IN SEAMEN WITH HIGH LEVELS OF WORK CAPACITY [OTSENKA FUNKTSIONAL'NOGO SOSTOIANIIA KARDIORESPIRATIVNOI SISTEMY U MORIAKOV S VYSOKIM UROVNEM FIZICHESKOI RABOTOSPOSOBNOSTI]

L. G. MEDVEDEV *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), June 1990, p. 60, 61. In Russian.

Copyright

The information content of various cardiorespiratory-system parameters with respect to the predicted level of work capacity of the subject was investigated in crews of three vessels navigating through different climatic zones for time periods of up to 75 days. The subjects, who were all trained athletes, were divided into control and experimental groups (six men each); subjects in the experimental group underwent twice-daily 30-min-long periods of submaximal-load physical exercises. Results showed that the values of systolic blood pressure and minute blood volume were the most informative indicators of cardiorespiratory-system state in physically trained seamen during long-term voyages. I.S.

A91-12044

PHYSIOLOGICAL EFFECTS OF HIGH-ALTITUDE AND EXERCISE-INDUCED HYPOCAPNIA [FIZIOLOGICHESKIE EFFEKTЫ VYSOTNOI I DVIGATEL'NOI GIPOKAPNII]

A. S. IVANOV (*Kazakhskii Institut Fizicheskoi Kul'tury, Alma-Ata, Kazakh SSR*) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 76, May 1990, p. 685-691. In Russian. refs

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The effects of high-altitude and exercise-induced hypocapnia on the respiration parameters, the blood gas composition, and the acid-base state of humans were investigated in 10 young men during ascent from an altitude of 800 m above sea level to a height of 3340 m. It was found that arterial hypocapnia started to develop at 2000-2500 m. However, it was found that, under maximal muscular load, the arterial CO₂ pressure decreases in comparison with the initial value, regardless of the altitude. I.S.

N91-10554# Joint Publications Research Service, Arlington, VA. CENTRAL AND REGIONAL HEMODYNAMICS IN PROLONGED SPACE FLIGHTS Abstract Only

V. F. TURCHANINOVA, A. D. YEGOROV, and M. V. DOMRACHEVA *In its JPRS Report: Science and Technology. USSR: Life Sciences* p 2 26 Jul. 1990 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina*, Moscow (USSR), v. 23, no. 6, Nov. - Dec. 1989 p 19-26

Avail: NTIS HC/MF A03

An analysis was conducted on changes in central and regional hemodynamics on cosmonauts during ten short-term (7 days) and nine long-term (65 to 237 days) on Salyut 6-Soyuz and Salyut 7-Soyuz space flights using tetrapolar rheography. Hemodynamic monitoring, in conjunction with stress-testing and negative pressure on the lower part of the body, demonstrates that under conditions of weightlessness the increase in the activity of the vasomotor center and enhanced adrenergic mechanisms was due to a major blood volume shift to the lower extremities from the cardiopulmonary compartment. In short-term flights the heart rate remained essentially unchanged, while the stroke volume and minute volume diminished by 8 and 13 percent, respectively. In long-term flights the heart rate increased slightly, while the stroke and minutes volumes remained unaltered. The hemodynamic changes were interpreted to reflect ongoing adaptation and adjustment to weightlessness, a process that has been demonstrated to function for at least 237 days. Author

N91-10555# Joint Publications Research Service, Arlington, VA.

PROTECTIVE FUNCTIONS OF SKIN Abstract Only

O. V. IGNATOVA, A. A. BERLIN, Z. P. PAK, and I. G. POPOV *In its JPRS Report: Science and Technology. USSR: Life Sciences* p 1 26 Jul. 1990 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina*, Moscow (USSR), v. 23, no. 6, Nov. - Dec. 1989 p 15-19

Avail: NTIS HC/MF A03

A brief review is presented of changes in the protective functions of the skin under conditions of space flight. In general, confinement aboard space ships has been accompanied by loss of bactericidal properties and changes in the normal skin flora, changes that have been reported to persist for prolonged periods of time. It is generally accepted that the microclimatic conditions lead to functional changes in the skin that alter the normal pH, fatty acid, and amino acid profiles. The net change is a reduction in the bactericidal potency of the skin, and a change in the skin flora. Changes in bacterial flora in themselves eliminate normal bacterial antagonism. Finally, morphological changes in the epidermis further compromise the barrier function of the skin. Author

N91-10557# Joint Publications Research Service, Arlington, VA.

DIAGNOSTIC POSSIBILITIES OF INFILIGHT EKG MONITORING OF FLIGHT CREW Abstract Only

V. M. KONDRAKOV and V. I. SINOPALNIKOV *In its JPRS Report: Science and Technology. USSR: Life Sciences* p 1 16 Jul. 1990 Transl. into ENGLISH from *Voyenno-Meditsinskii* (Moscow, USSR), no. 5 May 1989 p 57-59

Avail: NTIS HC/MF A03

Ambulatory inflight electrocardiography (EKG) monitoring was carried out on 22 pilots, ranging in age from 35 to 45 years, to evaluate this method for pilot health screening. The results disclosed that the use of the Soviet Lenta-MT monitor facilitated diagnosis of latent forms of coronary heart disease, arrhythmia, and conductive disorders in 15 of the subjects. All had previously passed fitness certification after conventional stress testing, which points to the utility of the ambulatory inflight monitoring in uncovering potential health problems in pilots. Author

N91-10558# Joint Publications Research Service, Arlington, VA. EFFECTS OF ROLLING MOTION ON THE CIRCADIAN RHYTHM OF SINOATRIAL NODE Abstract Only

A. M. MARCHENKO *In its JPRS Report: Science and Technology. USSR: Life Sciences* p 1 16 Jul. 1990 Transl. into ENGLISH from *Voyenno-Meditsinskii* (Moscow, USSR), no. 5, May 1989 p 59-61

Avail: NTIS HC/MF A03

Electrocardiography (EKG) studies were performed on 33 healthy sailors with a mean age of 37.5 years to assess the effects of seasickness on circadian rhythm of the sinoatrial node. The results demonstrate considerable individual variability in susceptibility to desynchronization of the self-excitation pattern and attendant deterioration of capacity for work. In individuals regarded as well adapted, usually with a work history of 10 to 15 years at sea, the changes were less pronounced and recovery was more rapid. This approach was felt to provide an objective assessment of the severity of seasickness, an important factor in determining occupational fitness and health status. Author

N91-10559# Joint Publications Research Service, Arlington, VA.

PROBABILITY OF DECOMPRESSION SICKNESS DURING SPACE SUIT TESTING Abstract Only

S. N. FILIPENKOV *In its JPRS Report: Science and Technology. USSR: Life Sciences* p 1 16 Jul. 1990 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina* (Moscow, USSR), v. 23, no. 3, May - Jun. 1989 p 53-58

Avail: NTIS HC/MF A03

The results are presented derived from an extensive series of trials conducted on space suits and decompression procedures to assess their efficacy in prevention of Decompression Sickness (DS). The studies involved 193 volunteers with good tolerance of moderate hypoxia and low barometric pressure. The data demonstrated that with long physical exertions and in-suit pressures

of 105 to 320 mm Hg, commonly employed decompression procedures are effective in preventing DS with the probability of 0.75 to 0.9 after 1 to 2 hours of oxygen inhalation under terrestrial-equivalent conditions. A probability of 0.9 to 0.98 for the prevention of DS was theoretically attainable with a short period of decompression for several minutes with a coefficient of supersaturation of 3.5 to 5.4. However, with a coefficient of supersaturation of 1.9 to 2.1 success in prevention DS with a probability of 0.98 to 0.99 was shown to require oxygen breathing for 0.5 to 1 hour.

Author

**N91-10560# Joint Publications Research Service, Arlington, VA.
CHANGES IN MAXIMUM ALLOWABLE SUPERSATURATION
COEFFICIENT IN HIGH-ALTITUDE DECOMPRESSION Abstract
Only**

V. I. CHADOV and L. R. ISEYEV *In its JPRS Report: Science and Technology. USSR: Life Sciences p 1 16 Jul. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 23, no. 3, May - Jun. 1989 p 58-62*

Avail: NTIS HC/MF A03

Male volunteers were used in pressure chamber studies designed to assess in the Maximum Allowable Coefficient of Supersaturation (MACS) in relation to pressure after decompression, in order to assess the safety of high-altitude decompression procedures. The 70 volunteers ranged in age from 21 to 47 years underwent a total of 383 measurements that simulated transition from an orbital station to a space suit at reduced oxygen tension. MACS values were seen to decrease from 1.661 at 452 kPa (6300 m, 339 mm Hg), to 1.608 at 467 kPa (6080 m, 350 mm Hg), to 1.55 at 268 kPa (201 mm Hg), and 1.24 at 240 kPa (180 mm Hg). In practical terms the plots of coefficient of supersaturation vs. pressure after decompression demonstrated that MACS does not change significantly over an altitude range of 6100 to 9300 m, retaining value of essentially 1.6. Accordingly, this figure provides an acceptable margin of safety for prevention of decompression sickness.

Author

**N91-10561# Joint Publications Research Service, Arlington, VA.
EFFECTS OF PROLONGED EXPOSURE TO ACETIC ACID
VAPORS ON ACID-BASE BALANCE IN HUMANS Abstract
Only**

L. KH. BRAGIN *In its JPRS Report: Science and Technology. USSR: Life Sciences p 2 16 Jul. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 23, no. 3, May - Jun. 1989 p 65-68*

Avail: NTIS HC/MF A03

Acid-base monitoring and determination of blood gases were conducted on 8 healthy males, 25 to 44 years old, to assess the physiological effects of prolonged exposure to 15 or 25 mg per cu m acetic acid vapors. Acetic acid was selected for the study because it is one of the key body surface metabolites and has previously been shown to be innocuous in concentrations of 10 mg per cu m. The experimental conditions utilized exposure for 20 days, with the temperature elevated to 33 C from day 16 through day 19 in one set of experiments and from day 6 to day 9 in another. The blood chemistries demonstrated that the low exposure level was innocuous in the long run, with any changes that were observed of limited duration. Data on the higher dosage showed more pronounced alteration in acid-base equilibrium, but again within physiological limits and without long-term sequels. Nevertheless, a concentration of 25 mg per cu m was felt to represent the upper limit of physiologically tolerable acetic acid concentration in the environment.

Author

**N91-10563# Joint Publications Research Service, Arlington, VA.
COMBINED EFFECTS OF ELEVATED CONCENTRATIONS OF
CARBON DIOXIDE AND AMBIENT TEMPERATURE ON
THERMAL STATE OF HUMANS IN CLOSED CHAMBERS
Abstract Only**

A. V. SOSNOVSKIY *In its JPRS Report: Science and Technology. USSR: Life Sciences p 2 16 Jul. 1990 Transl. into ENGLISH*

from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 23, no. 3, May - Jun. 1989 p 89-90

Avail: NTIS HC/MF A03

An analysis was conducted on the thermal state of 10 males exposed to elevated carbon dioxide concentrations and temperatures in 50 cu m closed chambers for 5 days. The experimental parameters were as follows: 26 to 28 C, 70 to 85 percent rel. humidity, 740 to 770 mm Hg barometric pressure, 3 to 3.5 percent CO₂, 20 to 21 percent O₂, and N₂ to make 100 percent gas mixture. Physiological monitoring showed that mean body temperature remained unaffected as a result of elevation of the skin temperature by 0.7 C and a reduction in rectal temperature by 0.5 C. However, both the respiratory and heart rates were significantly increased. On balance, the data indicated that the level of discomfort and changes in body temperature regulation under the combined effect of elevated concentrations of carbon dioxide and ambient temperature serve to diminish work performance.

Author

**N91-10566# Joint Publications Research Service, Arlington, VA.
REQUIREMENTS FOR AN IDEAL DRUG FOR PREVENTING
SPACE MOTION SICKNESS**

N. N. KARKISHCHENKO *In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-3 11 Jul. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 6 Nov. - Dec. 1989 p 33-36*

Avail: NTIS HC/MF A03

The imperfect state of medical protection against Space Motion Sickness (SMS) is largely due to insufficient study of the mechanisms underlying this syndrome and the lack of theoretical approaches that could be used to formulate the property requirements of an ideal drug and produce highly effective prescriptions. The existing pharmacological methods are insufficiently effective. The action of existing agents is chiefly aimed at suppressing the central links of vestibular reflexes by acting upon the chemoreceptor trigger zone and vestibular nuclei. However, the onset of intensive vestibular-autonomic disturbances during motion sickness is associated with the generalized propagation of stimulation along Central Nervous System (CNS) structures that originated from the vestibular apparatus. In this connection, the use of anti-epileptic agents that affect the intercentral reciprocal relationships in the CNS to restrict such stimulation may be quite promising. At the same time, the generalized propagation of stimulation along the CNS structures during which typical SMS disturbances occur in the sensory, motor, and autonomic areas is a result of the excessively pronounced vestibular asymmetry that occurs in microgravity. The use of adaptive agents that stimulate the synthesis of nucleic acids and protein and that activate energy metabolism must be conducive to the formation of adaptive changes in vestibular analyzer function and asymmetry compensation. The research was undertaken with the purpose of identifying and substantiating the range of effects and action mechanisms of drugs that might be used to produce a powerful, low-toxic drug to prevent SMS.

Author

**N91-10567# Joint Publications Research Service, Arlington, VA.
EFFECT OF SINGLE IMPACTS OF HEAVY IONS OF
GALACTIC COSMIC RAYS ON LACTUCA SATIVA SEEDS
EXPOSED ON SALYUT-6 AND SALYUT-7 STATIONS**

L. V. NEVZGODINA, YE. N. MAKSIMOVA, and YE. V. KAMINSKAYA *In its JPRS Report: Science and Technology. USSR: Life Sciences p 3-7 11 Jul. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 6, Nov. - Dec. 1989 p 66-70*

Avail: NTIS HC/MF A03

In spite of the comparatively low doses of total ionizing radiation received during space flights, radiation alterations did take place in biological test objects. Such changes can be induced by protons and gamma rays at doses 100 or 1000 higher than the doses received in flight. Therefore, the results of the space flight experiments cannot be easily associated with protons. It would seem more probable that the observed alterations are associated

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with the passage of some heavy ions (HI) of galactic cosmic rays (GCR) through the biological object. Calculations have shown that when HI pass through biological tissue in a 2 to 20 nm radius track area, the energy released is equivalent to a dose of several hundred rads. Inasmuch as the HI energy transfer is markedly localized, the observed effects may result from the impact of these particles in the region of certain sensitive cellular structures. The effect of single HI of GCR was studied during extensive flights on the orbiting manned stations Salyut. Air-dried *Lactuca sativa* lettuce seeds were employed as the biological test object. Author

N91-10574*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

WORKSHOP ON EXERCISE PRESCRIPTION FOR LONG-DURATION SPACE FLIGHT

BERNARD A. HARRIS, JR., ed. and DONALD F. STEWART, ed. Washington Oct. 1989 125 p Workshop held in Houston, TX, 1986 (NASA-CP-3051; S-597; NAS 1.55:3051) Avail: NTIS HC/MF A06 CSCL 06P

The National Aeronautics and Space Administration has a dedicated history of ensuring human safety and productivity in flight. Working and living in space long term represents the challenge of the future. Our concern is in determining the effects on the human body of living in space. Space flight provides a powerful stimulus for adaptation, such as cardiovascular and musculoskeletal deconditioning. Extended-duration space flight will influence a great many systems in the human body. We must understand the process by which this adaptation occurs. The NASA is aggressively involved in developing programs which will act as a foundation for this new field of space medicine. The hallmark of these programs deals with prevention of deconditioning, currently referred to as countermeasures to zero g. Exercise appears to be most effective in preventing the cardiovascular and musculoskeletal degradation of microgravity.

N91-10575*# Methodist Hospital, Indianapolis, IN. Dept. of Medical Research.

US SPACE FLIGHT EXPERIENCE. PHYSICAL EXERTION AND METABOLIC DEMAND OF EXTRAVEHICULAR ACTIVITY: PAST, PRESENT, AND FUTURE

THOMAS P. MOORE /n NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 3-13 Oct. 1989

Avail: NTIS HC/MF A06 CSCL 06P

A review of physical exertion and metabolic demands of extravehicular activity (EVA) on U.S. astronauts is given. Information is given on EVA during Gemini, Apollo and Skylab missions. It is noted that nominal EVA's should not be overstressful from a cardiovascular standpoint; that manual-intensive EVA's such as are planned for the construction phase of the Space Station can and will be demanding from a muscular standpoint, primarily for the upper extremities; that off-nominal unplanned EVA's can be physically demanding both from an endurance and from a muscular standpoint; and that crewmembers should be physically prepared and capable of performing these EVA's at any time during the mission. Author

N91-10577*# Methodist Hospital, Indianapolis, IN. THE HISTORY OF IN-FLIGHT EXERCISE IN THE US MANNED SPACE PROGRAM

THOMAS P. MOORE /n NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 19-21 Oct. 1989

Avail: NTIS HC/MF A06 CSCL 06P

A historical perspective on in-flight exercise in the U.S. manned space program is given. We have learned a great deal in the 25 years since the inception of Project Mercury. But, as we look forward to a Space Station and long-duration space flight, we must recognize the challenge that lies ahead. The importance of maintenance of the crewmember's physical condition during long stays in weightlessness is a prime concern that should not be minimized. The challenge lies in the design and development of

exercise equipment and protocols that will prevent or minimize the deleterious sequelae of long-duration space flight while maximizing valuable on-orbit crew time. Author

N91-10578*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

WORK, EXERCISE, AND SPACE FLIGHT. 1: OPERATIONS, ENVIRONMENT, AND EFFECTS OF SPACEFLIGHT

WILLIAM THORNTON /n its Workshop on Exercise Prescription for Long-Duration Space Flight p 23-30 Oct. 1989

Avail: NTIS HC/MF A06 CSCL 06P

The selection, training, and operations of space flight impose significant physical demands which seem to be adequately met by the existing physical training facilities and informal individual exercise programs. The professional astronaut population has, by selection, better than average health and physical capacity. The essentials of life on earth are adequately met by the spacecraft. However, as the human body adapts to weightlessness, it is compromised for the usual life on earth, but readaptation is rapid. Long term flight without countermeasures will produce major changes in the cardiovascular, respiratory, musculoskeletal and neuromuscular systems. There is strong theoretical and experimental evidence from 1-g studies and limited in-flight evidence to believe that exercise is a key counter-measure to many of these adaptations. Author

N91-10579*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

WORK, EXERCISE, AND SPACE FLIGHT. 3: EXERCISE DEVICES AND PROTOCOLS

WILLIAM THORNTON /n its Workshop on Exercise Prescription for Long-Duration Space Flight p 31-42 Oct. 1989

Avail: NTIS HC/MF A06 CSCL 06P

Preservation of locomotor capacity by earth equivalent, exercise in space is the crucial component of inflight exercise. At this time the treadmill appears to be the only way possible to do this. Work is underway on appropriate hardware but this and a proposed protocol to reduce exercise time must be tested. Such exercise will preserve muscle, bone Ca(++) and cardiovascular-respiratory capacity. In addition, reasonable upper body exercise can be supplied by a new force generator/measurement system-optimal exercise might include a rowing machine and bicycle ergometer. A subject centered monitoring-evaluation program will allow real time adjustments as required. Absolute protection for any astronaut will not be possible and those with hypertrophied capacities such as marathoners or weight lifters will suffer significant loss. However, the program described should return the crew to earth with adequate capacity of typical activity on earth including immediate ambulation and minimal recovery time and without permanent change. An understanding of the practical mechanics and biomechanics involved is essential to a solution of the problem. Author

N91-10580*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

SPACE MEDICINE CONSIDERATIONS: SKELETAL AND CALCIUM HOMEOSTASIS

VICTOR B. SCHNEIDER /n its Workshop on Exercise Prescription for Long-Duration Space Flight p 47-52 Oct. 1989

Avail: NTIS HC/MF A06 CSCL 06P

Based on the information obtained from space missions, particularly Skylab and the longer Salyut missions, it is clear that bone and mineral metabolism is substantially altered during space flight. Calcium balance becomes increasingly more negative throughout the flight, and the bone mineral content of the os calcis declines. The major health hazards associated with skeletal changes include the signs and symptoms of hypercalcemia with rapid bone turnover, the risk of kidney stones because of hypercalciuria, the lengthy recovery of lost bone mass after flight, the possibility of irreversible bone loss (particularly the trabecular bone), the possible effects of metastated calcification in the soft tissues, and the possible increase in fracture potential. For these reasons, major efforts need to be directed toward elucidating the

fundamental mechanisms by which bone is lost in space and developing more effective countermeasures to prevent both short-term and long-term complications.

Author

**N91-10581*# Creighton Univ., Omaha, NE.
CHANGES IN MINERAL METABOLISM WITH
IMMOBILIZATION/SPACE FLIGHT**

J. C. GALLAGHER *In NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 53-55 Oct. 1989*

Avail: NTIS HC/MF A06 CSCL 06P

Researchers are still unsure of the accuracy of previous bone density measurements of their significance following a period of weightlessness. Rapid technological advances in the measurement of bone density will enable us now to measure bone density accurately at multiple sites in the skeleton with doses of radiation less than that given by a spine x ray. It may not be possible to obtain this type of information before the next series of space flights take place, although the bed-rest model may provide supporting information. Extensive testing of bone density on every astronaut should be performed before and after the space flight. Prevention and treatment can only be undertaken after gathering sufficient baseline information. The use of exercise in preventing bone loss is still highly speculative, but represents a relatively easy approach to the problem in terms of study.

Author

**N91-10582*# West Virginia Univ., Morgantown. Dept. of
Physiology and Neurology**

**A UNIQUE PROBLEM OF MUSCLE ADAPTATION FROM
WEIGHTLESSNESS: THE DECELERATION DEFICIENCY**

WILLIAM T. STAUBER *In NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 57-59 Oct. 1989*

Avail: NTIS HC/MF A06 CSCL 06P

Decelerator problems of the knee are emphasized since the lower leg musculature is known to atrophy in response to weightlessness. However, other important decelerator functions are served by the shoulder muscles, in particular the rotator cuff muscles. Problems in these muscles often result in tears and dislocations as seen in baseball pitchers. It is noteworthy that at least one device currently exists that can measure concentric and eccentric muscle loading including a submaximal simulated free weight exercise (i.e., force-controlled) and simultaneously record integrated EMG analysis appropriate for assessment of all muscle functional activities. Studies should be undertaken to provide information as to the performance of maximal and submaximal exercise in space travelers to define potential problems and provide rationale for prevention.

Author

N91-10583*# Pennsylvania State Univ., University Park. Center for Locomotion Studies.

**BIOMEDICAL PERSPECTIVES ON LOCOMOTION IN NULL
GRAVITY**

PETER R. CAVANAGH *In NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 61-67 Oct. 1989*

Avail: NTIS HC/MF A06 CSCL 06P

A number of important features of various locomotor activities are discussed, and approaches to the study of these activities in the context of space flight are suggested. In particular, the magnitude of peak forces and the rates of change of force during terrestrial cycling, walking, and running are compared. It is shown that subtle changes in the conditions and techniques of locomotion can have a major influence on the biomechanical consequences to the skeleton. The various hypotheses that identify locomotor exercise as a countermeasure to bone demineralization during weightlessness deserve to be tested with some degree of biomechanical rigor. Various approaches for achieving such scrutiny are discussed.

Author

N91-10584*# California Univ., Los Angeles. Dept. of Kinesiology.

**EXERCISE ISSUES RELATED TO THE NEUROMUSCULAR
FUNCTION AND ADAPTATION TO MICROGRAVITY**

REGGIE EDGERTON *In NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 77-78 Oct. 1989*

Avail: NTIS HC/MF A06 CSCL 06P

Explored here is the question of whether astronauts can perform extravehicular activities effectively, efficiently, and productively. The loss of muscle mass, movement control, central nervous system function, muscle atrophy and fatigue, all consequent to weightlessness exposure, are discussed. The author recommends more research in these areas.

Author

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CONSIDERATIONS FOR AN EXERCISE PRESCRIPTION

VICTOR A. CONVERTINO *In NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 99-105 Oct. 1989*

Avail: NTIS HC/MF A06 CSCL 06P

A number of past and most recent research findings that describe some of the physiological responses to exercise in man and their relationship with exposure to various gravitational environments are discussed. Most of the data pertain to adaptations of the cardiovascular and body fluid systems. It should be kept in mind that the data from studies on microgravity simulation in man include exposures of relatively short duration (5 hours to 14 days). However, it is argued that the results may provide important guidelines for the consideration of many variables which are pertinent to the development of exercise prescription for long-duration space flight. The following considerations for exercise prescriptions during long-duration space flight are noted: (1) Relatively high aerobic fitness and strength, especially of the upper body musculature, should be a criterion for selection of astronauts who will be involved in EVA, since endurance and strength appear to be predominant characteristics for work performance. (2) Some degree of upper body strength will probably be required for effective performance of EVA. However, the endurance and strength required by the upper body for EVA can probably be obtained through preflight exercise prescription which involves swimming. (3) Although some degree of arm exercise may be required to maintain preflight endurance and strength, researchers propose that regular EVA will probably be sufficient to maintain the endurance and strength required to effectively perform work tasks during space flight. (4) A minimum of one maximal aerobic exercise every 7 to 10 days during space flight may be all that is necessary for maintenance of normal cardiovascular responsiveness and replacement of body fluids for reentry following prolonged space flight. (5) The possible reduction in the amount of exercise required for maintenance of cardiovascular system and body fluids in combination with the use of electromyostimulation (EMS) or methods other than conventional exercise for maintaining size and strength of muscles and bones needs great consideration for further research. These approaches represent a potential solution to the problem of compromising valuable time for exercise that is needed for daily operations.

Author

N91-10586*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**WORK, EXERCISE, AND SPACE FLIGHT. 2: MODIFICATION
OF ADAPTATION BY EXERCISE (EXERCISE PRESCRIPTION)**

WILLIAM THORNTON *In its Workshop on Exercise Prescription for Long-Duration Space Flight p 107-115 Oct. 1989*

Avail: NTIS HC/MF A06 CSCL 06P

The fundamentals of exercise theory on earth must be rigorously understood and applied to prevent adaptation to long periods of weightlessness. Locomotor activity, not weight, determines the capacity or condition of the largest muscles and bones in the body and usually also determines cardio-respiratory capacity. Absence of this activity results in rapid atrophy of muscle, bone, and cardio-respiratory capacity. Upper body muscle and bone are

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less affected depending upon the individual's usual, or 1-g, activities. Methodology is available to prevent these changes but space operations demand that it be done in the most efficient fashion, i.e., shortest time. At this point in time we can reasonably select the type of exercise and methods of obtaining it, but additional work in 1-g will be required to optimize the time.

Author

N91-10587*# Texas Univ. Health Science Center, Dallas. Div. of Cardiology.

CARDIOVASCULAR GROUP

GUNNAR BLOMQVIST /n NASA, Johnson Space Center, Workshop on Exercise Prescription for Long-Duration Space Flight p 117-123 Oct. 1989

Avail: NTIS HC/MF A06 CSCL 06P

As a starting point, the group defined a primary goal of maintaining in flight a level of systemic oxygen transport capacity comparable to each individual's preflight upright baseline. The goal of maintaining capacity at preflight levels would seem to be a reasonable objective for several different reasons, including the maintenance of good health in general and the preservation of sufficient cardiovascular reserve capacity to meet operational demands. It is also important not to introduce confounding variables in whatever other physiological studies are being performed. A change in the level of fitness is likely to be a significant confounding variable in the study of many organ systems. The principal component of the in-flight cardiovascular exercise program should be large-muscle activity such as treadmill exercise. It is desirable that at least one session per week be monitored to assure maintenance of proper functional levels and to provide guidance for any adjustments of the exercise prescription. Appropriate measurements include evaluation of the heart-rate/workload or the heart-rate/oxygen-uptake relationship. Respiratory gas analysis is helpful by providing better opportunities to document relative workload levels from analysis of the interrelationships among VO₂, VCO₂, and ventilation. The committee felt that there is no clear evidence that any particular in-flight exercise regimen is protective against orthostatic hypotension during the early readaptation phase. Some group members suggested that maintenance of the lower body muscle mass and muscle tone may be helpful. There is also evidence that late in-flight interventions to reexpand blood volume to preflight levels are helpful in preventing or minimizing postflight orthostatic hypotension.

Author

N91-10588*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

SUMMARY AND RECOMMENDATIONS FOR INITIAL EXERCISE PRESCRIPTION

DONALD F. STEWART and BERNARD A. HARRIS, JR. (Space Biomedical Research Inst., Houston, TX.) /n its Workshop on Exercise Prescription for Long-Duration Space Flight p 125-130 Oct. 1989

Avail: NTIS HC/MF A06 CSCL 06P

The recommendations summarized herein constitute a basis on which an initial exercise prescription can be formulated. It is noteworthy that any exercise program designed currently would be an approximation. Examination of the existing space-flight data reveals a scarcity of in-flight data on which to rigorously design an exercise program. The relevant experience within the U.S. space program (with regard to long-duration space flight) is limited to the Skylab Program. Lessons learned from Skylab are relevant to the design of a Space Station exercise program, especially with regard to the total length of exercise time required, cardiovascular (CV) deconditioning/reconditioning, and bone loss. Certain observations of the U.S.S.R. exercise activities can also contribute to the formulation of an exercise prescription of Space Station. Reportedly, the U.S.S.R. uses both a bicycle ergometer and a treadmill device on long-duration missions with some degree of success. Using the third crew of Salyut 6, which was a 175-day stay, as a representative mission, the typical time dedicated to exercise varies from 2 to 3 hours per day. In addition, the cosmonauts wear an elasticized suit, called a penguin suit, for time periods ranging from 12 to 16 hours per day. This device

provides a load across the axial skeleton against which the wearer must exert himself. Despite these extensive countermeasures, the effects of adaptation are not totally prevented.

Author

N91-10589*# Joint Publications Research Service, Arlington, VA. **JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

13 Jun. 1989 38 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-89-008) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following areas are covered: biophysics; laser bioeffects; medicine; pharmacology and toxicology; physiology; public health; and virology.

M.G.

N91-10590*# Joint Publications Research Service, Arlington, VA. **JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

29 Sep. 1989 43 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-89-010) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: agriculture; biochemistry; microbiology; nonionizing radiation effects; pharmacology and toxicology; physiology; public health; and psychology.

M.G.

N91-10591*# Good Samaritan Hospital and Medical Center, Portland, OR. Neurological Sciences Inst.

ROLE OF ORIENTATION REFERENCE SELECTION IN MOTION SICKNESS Semiannual Status Report

ROBERT J. PETERKA and F. OWEN BLACK Sep. 1990 37 p (Contract NAG9-117)

(NASA-CR-186612; NAS 1.26:186612) Avail: NTIS HC/MF A03 CSCL 06E

Three areas related to human orientation control are investigated: (1) reflexes associated with the control of eye movements and posture; (2) the perception of body rotation and position with respect to gravity; and (3) the strategies used to resolve sensory conflict situations which arise when different sensory systems provide orientation cues which are not consistent with one another or with previous experience. Of particular interest is the possibility that a subject may be able to ignore an inaccurate sensory modality in favor of one or more other sensory modalities which do provide accurate orientation reference information. This process is referred as sensory selection. This proposal will attempt to quantify subject's sensory selection abilities and determine if this ability confers some immunity to the development of motion sickness symptoms.

Author

N91-10592*# Pacific Northwest Lab., Richland, WA. **INTERACTION OF EXTREMELY LOW-FREQUENCY ELECTROMAGNETIC FIELDS WITH HUMANS**

T. S. TENFORDE Apr. 1990 3 p Presented at the Annual Meeting of the Division of Physics of Beams of the American Physical Society, Washington, DC, 16-19 Apr. 1990 (Contract DE-AC06-76RL-01830)

(DE90-017190; PNL-SA-17819; CONF-900495-2) Avail: NTIS HC/MF A01

Public concern has grown in recent years concerning the possible health effects of extremely low frequency (ELF) electromagnetic fields to which we are exposed in all aspects of everyday life. By definition ELF refers to the range of electromagnetic field frequencies below 300 Hz, which includes the power transmission and distribution frequencies used throughout the world. In materials with the electrical and magnetic properties of living tissues, these fields have a long wavelength (5000 m) and skin depth (150 m). As a consequence, in their interactions with humans and other living organisms ELF fields behave as though they are composed of independent electric and magnetic fields components. ELF fields and their interactions with humans and other living organisms as well as their biological effects are discussed.

DOE

N91-10593# Pacific Northwest Lab., Richland, WA.

STATISTICAL METHODS FOR ANALYZING AND COMBINING DATA ON LOW-LEVEL EXPOSURES TO IONIZING RADIATION

ETHEL S. GILBERT Jul. 1990 5 p Presented at the American Statistical Association Conference on Radiation and Health, Copper Mountain, CO, 8-13 Jul. 1990
(Contract DE-AC06-76RL-01830)

(DE90-017193; PNL-SA-18391; CONF-9007165-2) Avail: NTIS HC/MF A01

Occupational studies of workers who have been exposed to radiation provide a direct assessment of low level radiation risks, and can serve as a check on estimates obtained through extrapolation from studies of populations exposed at high levels. Several studies of workers involved in the production of both defense materials and nuclear power in the United States, Great Britain, and Canada are being conducted. If the current risk estimates are correct, these studies have very low power for detecting risks, but can be used to provide useful upper limits on risks. If the current risk estimates are too low, the studies are adequate to detect large departures from these estimates. A broad assessment based on the totality of evidence from all occupational studies is obviously desirable, and such an assessment can be best accomplished by analyzing combined data from all studies. Plans for international combined analyses are underway, and combined analyses on a national scale are also being conducted. In the U.S., results based on combined data on male workers at the Hanford Site, Oak Ridge National Laboratory (ORNL), and Rocky Flats Weapons Plant have been published, and are used in this presentation to illustrate the application of various statistical procedures.

DOE

N91-10594* National Aeronautics and Space Administration, Washington, DC.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 341)

Oct. 1990 50 p

(NASA-SP-7011(341); NAS 1.21:7011(341)) Avail: NTIS HC A03; NTIS standing order as PB90-912300, \$11.50 domestic, \$23.00 foreign CSCL 06E

This bibliography lists 133 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during September 1990. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance.

Author

N91-11354# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

10 Feb. 1989 57 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-89-003) Avail: NTIS HC/MF A04

Abstracts of U.S.S.R. research in the life sciences are given. Topics covered include aerospace medicine, biochemistry, biophysics, biotechnology, immunology, laser bioeffects, microbiology, military medicine, molecular biology, toxicology, physiology, public health, psychology, and virology.

N91-11355# Joint Publications Research Service, Arlington, VA.
ENHANCEMENT OF HUMAN TOLERANCE OF ACUTE HYPOXIA BY ADAPTATION AND INTENSE TRAINING AT HIGH ALTITUDES Abstract Only

A. YU. KATKOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1 10 Feb. 1989 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 14, no. 3, May - Jun. 1988 p 441-445

Avail: NTIS HC/MF A04

A comparative analysis was conducted on tolerance of acute hypoxia by mountain climbers (74 males) and non-climbers (48 males), the latter subjected to adaptation and/or 3 days of intensive training under pressure chamber conditions (5000 to 9000 m). Pressure chamber studies showed that the mountain climbers

residing in subalpine areas tolerated an altitude of 9700 plus or minus 170 m for 56 plus or minus 2.2 min before mental clouding 5 to 6 months after the last climb. The corresponding parameters for mountain climbers residing in lowland areas were, respectively, 9200 plus or minus 150 m and 50 plus or minus 1.2 min. Maximum tolerance of the non-climber controls reached 8300 plus or minus 100 m, with a tolerance time of 41 plus or minus 1.0 min at that altitude. A day after the 3-day adaptation/training regimen, the figures improved to 9300 plus or minus 90 m and 50 plus or minus min. A 7- to 56-day excursion to elevations of 5621 to 8848 m by the lowland mountain climber raised their tolerance of hypoxia persisted for some 20 days. Analysis of cardio-vascular function tests and respiratory studies demonstrated that after adaptation to high altitudes in a pressure chamber set at 9000 m the coefficient of oxygen utilization in the climbers was higher than in the nonclimbers subjected to the 3-day regimen. Author

N91-11356# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

RADIOLOGICAL HEALTH RISKS TO ASTRONAUTS FROM SPACE ACTIVITIES AND MEDICAL PROCEDURES

LEIF E. PATERSON (Kelsey Seybold Clinic, P.A., Houston, TX.) and D. STUART NACHTWEY Aug. 1990 23 p
(NASA-TM-102164; S-610; NAS 1.15:102164) Avail: NTIS HC/MF A03 CSCL 06S

Radiation protection standards for space activities differ substantially from those applied to terrestrial working situations. The levels of radiation and subsequent hazards to which space workers are exposed are quite unlike anything found on Earth. The new more highly refined system of risk management involves assessing the risk to each space worker from all sources of radiation (occupational and non-occupational) at the organ level. The risk coefficients were applied to previous space and medical exposures (diagnostic x ray and nuclear medicine procedures) in order to estimate the radiation-induced lifetime cancer incidence and mortality risk. At present, the risk from medical procedures when compared to space activities is 14 times higher for cancer incidence and 13 times higher for cancer mortality; however, this will change as the per capita dose during Space Station Freedom and interplanetary missions increases and more is known about the risks from exposure to high-LET radiation.

Author

N91-11357# New Mexico Univ., Albuquerque. School of Medicine.

NITROGEN DIOXIDE AND RESPIRATORY INFECTION: PILOT INVESTIGATIONS Research Report, Jan. 1984 - Sep. 1987

JONATHAN M. SAMET and JOHN D. SPENGLER Sep. 1989 48 p Prepared in cooperation with Harvard School of Public Health, Boston, MA Sponsored by Health Effects Inst., Cambridge, MA
(PB90-247339; HEI/RR-89/28) Avail: NTIS HC/MF A03 CSCL 06P

A longitudinal study was designed with infants to determine if NO₂ exposure from cooking stoves increase the incidence or severity of respiratory infections during the first 18 months of life. Results of pilot investigations for the longitudinal study are reported. In the one study, 147 families of infants were recruited at two Albuquerque hospitals, and their homes were monitored for NO₂ using a passive sampling tube. Higher levels of NO₂ were found in homes with gas stoves than in homes with electric stoves. A sample of the homes showed that personal exposures of the infants could be estimated by room concentrations and mothers would complete a daily calendar-diary on respiratory symptoms and provide information every two weeks on illnesses occurring. In the other pilot study, 75 infants were recruited and followed for four months. The illness surveillance system was compared with the clinical assessments by the nurse practitioners and the subjects' physicians, and with viral cultures.

Author

52 AEROSPACE MEDICINE

N91-11370# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

THE APPLICATION OF USAF FEMALE ANTHROPOMETRIC DATA TO IDENTIFY PROBLEMS WITH THE INTRODUCTION OF FEMALE AIRCREW INTO THE ROYAL AIR FORCE

G. M. TURNER /n AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 3 p Aug. 1990
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The Royal Air Force (RAF) decided in 1989 to recruit female pilots and navigators. Since there is little statistical data on the distribution of the critical body dimensions for the UK female population the USAF female anthropometric data was employed to predict the effects of imposing the present RAF minimum selection limits on the female population. These predictions are discussed and the effects for individual aircraft types considered. Certain questions are raised concerning limb strength related to aircraft controls and to the possible requirement for a minimum weight for ejection seat occupants. The USAF female data so far employed was only from the published percentile tables. Further studies will be conducted using the raw data transferred from the US AMRL Data Bank Library to the Institute of Aviation Medicine computer.

Author

N91-11376# Institute of Aviation Medicine, Oslo (Norway).

PREGNANCY: A CAUSE FOR GROUNDING OF FEMALE AIR CREW

HARALD T. ANDERSEN and OTTAR LUNDE /n AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 3 p Aug. 1990 Prepared in cooperation with University Hospital, Oslo, Norway

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Military aviation is a rather demanding profession. The medical priorities pertinent to pregnant aviators are considered. Complications to pregnancy which are capable of causing events which interfere with flying duties are examined. The three trimesters of pregnancy are explained along with the problems each presents. The medical consequences of the operational requirements are considered as well as the complications outlined, since adequate treatment depends upon skilled intervention in well equipped institutions.

Author

N91-11377# School of Aerospace Medicine, Brooks AFB, TX. Clinical Sciences Div.

EKG FINDINGS IN FEMALE AVIATORS IN THE US AIR FORCE

ROBERT A. MUNSON /n AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 5 p Aug. 1990
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The initial EKGs from 309 female aviators and 309 age-matched male aviators were read to compare the prevalence of findings. Abnormal readings were unusual, as would be expected in this selected group. About 1.3 percent of the males and none of the females had abnormal readings, a difference which is not significant ($p = .0455$). The abnormal readings were two cases of left anterior hemiblock and two of Wolff-Parkinson-White. Possibly abnormal findings, which required a second order workup to rule out the presence of cardiac disease, occurred at a similar rate between the groups (22.7 percent of females vs 16.2 percent of males, $p = .0634$). The preponderance of possibly abnormal findings in women were due to nonspecific ST and T-wave abnormalities. Normal variant tracings were more common in men (60.2 percent female vs 74.1 percent male, $p = .0004$) while women were more likely to have an EKG without significant finding (17.1 percent females vs 8.4 percent male, $p = .0018$). These findings support the concept that EKG criteria that were developed for men can be used aeromedically for women.

Author

N91-11378# Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Human Systems Div.

IMPACT ON WOMEN: A RETROSPECTIVE LOOK AT IMPACT ACCELERATION TESTING AT THE HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY

CYNTHIA N. RANDALL and JAMES W. BRINKLEY /n AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 6 p Aug. 1990

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In today's society, women are occupying an increasing number of previously male dominated jobs. This is especially true in the United States Armed Forces. Women have served as pilots in the military since the early 1970's (1973 for Army and Navy; 1976 for Air Force) but cannot be assigned to high performance, ejection seat aircraft unless they are an instructor or test pilot. Consequently, research was directed at the 5th to 95th percentile male crewmember, and little information is available with respect to performance, limitations, and potential dangers that might be encountered with female aircrew. In the Biomechanical Protection Branch of the Harry G. Armstrong Aerospace Medical Research Laboratory (AAMRL), women are routinely used as subjects in impact experiments since 1976. Seven women of 132 total subjects (5.3 percent) have taken part in 110 of 2108 (5.2 percent) of the impact testing. Although the numbers are small, a retrospective review of the data obtained from these female subjects at AAMRL is provided and compared to the male subject data to determine if there are any trends.

Author

N91-11379# School of Aerospace Medicine, Brooks AFB, TX.

RELATIONSHIP OF MENSTRUAL HISTORY TO ALTITUDE CHAMBER DECOMPRESSION SICKNESS

FREDERICK W. RUDGE /n AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 4 p Aug. 1990 Submitted for publication

Copyright Avail: NTIS HC/MF A08; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Records at the United States Air Force School of Aerospace Medicine, Division of Hyperbaric Medicine, were reviewed to determine the relationship between the incidence of altitude chamber decompression sickness (DCS) in females and menstrual history. The study period spans 11 years, from January 1978 to December 1988. Eighty-one records were suitable for study. A significant inverse linear relationship was noted between the number of days since the start of last menstrual period and the incidence of DCS. This relationship was noted with both Type 1 and Type 2 DCS. Lack of information on the population at risk precluded an analysis of the effects of birth control pills on this phenomenon. The underlying mechanism for the correlation between menstrual cycle and susceptibility to development of DCS is unknown. The conclusion is that women are at higher risk of developing altitude-related decompression sickness during menses, with the risk decreasing linearly as the time since last menstrual period increases.

Author

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A91-10023#

ANTARCTIC ANALOGS OF HUMAN FACTORS ISSUES DURING LONG-DURATION SPACE MISSIONS

LARRY BELL (Houston, University, TX) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 7 p. refs

(AIAA PAPER 90-3564) Copyright

The Sasakawa International Center for Space Architecture

(SICSA) has undertaken requirement definition and planning studies for an international research and technology testbed facility in Antarctica to support future space mission simulations. This paper discusses the relevance of such an antarctic facility as an analog for examining human factors issues and requirements for long-duration space missions. It also highlights applications, benefits and limitations of other analogs from which important human factors lessons may be learned.

Author

**A91-10024#
PREDICTING EFFECTS OF INTERACTIVE STRESSES ON
HUMAN PERFORMANCE DURING LONG-DURATION SPACE
OPERATIONS**

P. A. HANCOCK, J. K. CAIRD (Minnesota, University, Minneapolis), and R. PARASURAMAN (Catholic University of America, Washington, DC) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 6 p. refs (AIAA PAPER 90-3565) Copyright

This paper examines the theoretical foundations which allow the prediction of operator performance capability under the effects of interactive sources of stress. The overwhelming predominance of the single source of disturbance, microgravity, defies simple extensions to most models founded on the examination of the influences of more common terrestrial sources. However, a contemporary model is evaluated that promises to provide a possible avenue of resolution.

Author

**A91-10091*# National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.
LONG DURATION MISSION SUPPORT OPERATIONS
CONCEPTS**

T. W. EGGLESTON (NASA, Johnson Space Center, Houston, TX) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 8 p. refs (AIAA PAPER 90-3682) Copyright

It is suggested that the system operations will be one of the most expensive parts of the Mars mission, and that, in order to reduce their cost, they should be considered during the conceptual phase of the Space Exploration Initiative (SEI) program. System operations of Space Station Freedom, Lunar outpost, and Mars Rover Sample Return are examined in order to develop a similar concept for the manned Mars mission. Factors that have to be taken into account include: (1) psychological stresses caused by long periods of isolation; (2) the effects of boredom; (3) the necessity of onboard training to maintain a high level of crew skills; and (4) the 40-min time delays between issuing and receiving a command, which make real-time flight control inoperative and require long-term decisions to be made by the ground support.

B.P.

**A91-10132*# Texas Univ., Austin.
STRATEGIES FOR CREW SELECTION FOR LONG DURATION
MISSIONS**

ROBERT L. HELMREICH (Texas, University, Austin), ALBERT W. HOLLAND, PATRICIA A. SANTY (NASA, Johnson Space Center, Houston, TX), ROBERT M. ROSE (Minnesota, University, Minneapolis), and TERRY J. MCFADDEN AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 6 p. refs (Contract NCC2-286)

(AIAA PAPER 90-3762) Copyright

Issues surrounding psychological reactions to long duration spaceflight are discussed with respect to the definition of criteria for selecting crewmembers for such expeditions. Two broad dimensions of personality and behavior are defined - Instrumentality including achievement orientation, leadership, and ability to perform under pressure and Expressivity encompassing interpersonal sensitivity and competence. A strategy for validating techniques to select in candidates with the optimum psychological profile to perform successfully on long duration missions is described.

Author

**A91-10133#
PSYCHOSOCIAL SUPPORT FOR LONG-DURATION SPACE
CREWS**

NICK KANAS (USVA, Medical Center; California, University, San Francisco) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 8 p. refs (AIAA PAPER 90-3763)

The effects of long space missions on the psychological well-being and interpersonal relationships of crew members are discussed, summarizing the results of experimental simulations, studies on earth-based analogs such as submarine voyages and Antarctic expeditions, and reports on the Soviet space experience. A number of typical problems are identified, and the implications for crew selection, preflight training, in-flight support, and postflight debriefing are explored. It is pointed out that the procedures for deep-space missions such as a Mars landing, where crews will be isolated for months or years, should be different than those for near-earth missions such as the Space Station, where crews can be rotated at regular intervals.

T.K.

**A91-10134*# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, CA.**

**TEAMWORK IN HIGH-RISK ENVIRONMENTS ANALOGOUS TO
SPACE**

BARBARA G. KANKI (NASA, Ames Research Center, Moffett Field, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 8 p. refs (AIAA PAPER 90-3764) Copyright

Mountaineering expeditions combine a number of factors which make them potentially good analogs to the planetary exploration facet of long-duration space missions. A study of mountain climbing teams was conducted in order to evaluate the usefulness of the environment as a space analog and to specifically identify the factors and issues surrounding teamwork and 'successful' team performance in two mountaineering environments. This paper focuses on social/organizational factors, including team size and structure, leadership styles and authority structure which were found in the sample of 22 climb teams (122 individuals). The second major issue discussed is the construction of a valid performance measure in this high-risk environment.

Author

**A91-10135#
LEADERSHIP AND GROUP BEHAVIOR IN HUMAN
SPACEFLIGHT OPERATIONS**

LARRY W. PENWELL (Mary Washington College, Fredericksburg, VA) and JOHN M. NICHOLAS (Loyola University, Chicago, IL) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 11 p. refs (AIAA PAPER 90-3766) Copyright

The role of leadership (L) in the interpersonal relationships among spacecraft crew members and personnel in analogous situations such as aircraft and polar bases is examined, summarizing anecdotal evidence and the results of psychological studies. The social-scientific definition of L is discussed, differentiating L from authority, influence, and power, and the systems approach to the analysis of space missions is explained. Particular attention is then given to the authority structure of the NASA manned space programs, leader and crew selection procedures, the effect of L on aircrew performance, the attitudes and psychological characteristics of effective pilots, communication patterns in aircrews, L factors in polar bases and on mountaineering expeditions, and ocean analogs such as offshore oil rigs and submersibles. The attributes and skills of effective leaders are listed in a table, and the limitations of analog studies are briefly considered.

T.K.

**N91-10564# Joint Publications Research Service, Arlington, VA.
PSYCHOPHYSIOLOGICAL ASSESSMENT OF PILOTING
MOTOR HABITS IN PILOT RETRAINING Abstract Only**

N. N. FROLOV and A. S. KUZMIN *In its* JPRS Report: Science and Technology, USSR: Life Sciences p 2 16 Jul. 1990 Transl into ENGLISH from Vojenno-Meditsinskiy (Moscow, USSR), no.

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1, Jan. 1989 p 54-57
Avail: NTIS HC/MF A03

An analysis was conducted on the motor activity of pilots undergoing retraining on single-seat airplanes during landing maneuvers. The study was performed with 56 pilots during 290 flights. In general, as the pilots gained familiarity and experience with the new planes there was a gradual reduction in the number of control column movements and their amplitudes. Correspondingly, the quality of landings improved. The reduction in the incidence of control and adjustment movements was accompanied by an increase in the number of fine feedback movements. Readjustment of pilot to new airplanes appears to involve fine-tuning of established habituated movements rather than a fundamental reconstructing of underlying motor activity inherent in piloting skills. Consequently, fine feedback movements that appear as second nature and represent a form of international automation may be used to assess the degree of piloting habituation.

Author

N91-10595*# Houston Univ., TX. Dept. of Psychology.
THE EFFECTS OF OUTCOME AND PROCESS FEEDBACK
DEBRA STEELE JOHNSON 25 Oct. 1990 82 p
(Contract NAG9-398)
(NASA-CR-187332; NAS 1.26:187332) Avail: NTIS HC/MF A05
CSCL 051

A study was conducted to examine the effects of process and outcome feedback on performance during a skill acquisition phase and a transfer test phase. The research also examined the role of two moderators: self-efficacy and intrinsic motivation. Subjects were college students participating for course credit. The task involved using a computerized simulation of the Space Shuttle's Remote Manipulation System (RMS). Results provided evidence of the beneficial effects of process feedback during skill acquisition. Results also provided evidence that self-efficacy and intrinsic motivation moderate the effects of feedback type on performance.

Author

N91-10947*# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, CA.

TECHNOLOGICAL ADVANCES FOR STUDYING HUMAN BEHAVIOR

RENATE J. ROSKE-HOFSTRAND *In* NASA, Langley Research Center, Aviation Safety/Automation Program Conference p 131-141 Oct. 1990

Avail: NTIS HC/MF A12 CSCL 051

Technological advances for studying human behavior are noted in viewgraph form. It is asserted that performance-aiding systems are proliferating without a fundamental understanding of how they would interact with the humans who must control them. Two views of automation research, the hardware view and the human-centered view, are listed. Other viewgraphs give information on vital elements for human-centered research, a continuum of the research process, available technologies, new technologies for persistent problems, a sample research infrastructure, the need for metrics, and examples of data-link technology.

Author

N91-10948*# Pacific Northwest Lab., Richland, WA.
ASSESSING THE FEASIBILITY, COST, AND UTILITY OF DEVELOPING MODELS OF HUMAN PERFORMANCE IN AVIATION

WILLIAM STILLWELL *In* NASA, Langley Research Center, Aviation Safety/Automation Program Conference p 143-149 Oct. 1990

Avail: NTIS HC/MF A12 CSCL 051

The purpose of the effort outlined in this briefing was to determine whether models exist or can be developed that can be used to address aviation automation issues. A multidisciplinary team has been assembled to undertake this effort, including experts in human performance, team/crew, and aviation system modeling, and aviation data used as input to such models. The project consists of two phases, a requirements assessment phase that is designed to determine the feasibility and utility of alternative modeling efforts, and a model development and evaluation phase

that will seek to implement the plan (if a feasible cost effective development effort is found) that results from the first phase. Viewgraphs are given.

Author

N91-11358*# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

RECRUITING, SELECTION, TRAINING AND MILITARY OPERATIONS OF FEMALE AIRCREW

Aug. 1990 173 p *In* ENGLISH and FRENCH Symposium held in Tours, France, 4-5 Apr. 1990

(AGARD-CP-491; ISBN-92-835-0576-X) Copyright Avail: NTIS HC/MF A08; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

There are now approximately one thousand female military aviators flying within the NATO nations. The experience of each nation with recruiting, selection, training, and military operations of female aircrew was reviewed. In addition, a section was devoted to the discussion of the physiological differences between male and female aviators, pregnancy, and flying. Once selected, there appear to be no basic differences in flight capabilities between men and women. There is a requirement to develop smaller helmets, oxygen masks and NBC respirators for females, and data were presented which showed that females are more susceptible to decompression sickness.

N91-11359*# Naval Air Station, Norfolk, VA. Fleet Logistics Support Squadron.

THE INTEGRATION OF WOMEN INTO US NAVY AIRCREW TRAINING AND SQUADRON ASSIGNMENTS

LINDA VAUGHT HUTTON *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 5 p Aug. 1990

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Aviation and military service are non-traditional career choices for women. Though obvious, the fact remains crucial to the success of integration programs. Much is written and said about the average woman: size, weight, strength, mental acuity, leadership, competitiveness, and drive to excel. But discussions on the average woman are erroneous; the average woman does not seek non-traditional career paths. The woman who seeks a non-traditional military career will be an intelligent, outspoken student of above-average ability; confident, gregarious, and competitive by nature; active and athletically inclined; and routinely found in leadership positions. This dynamic over-achiever personality does not fit statistical norms for a population wide average woman. However, these attributes do fit military aviator candidate profiles; the reason for successful integration. Cultural attitudes and biases are displaced by time. However with forethought and planning, the integration of women into naval aircrew training and squadron assignments can progress smoothly. A planning outline which covers employment intentions, development of an accession model, flight training attrition, aviation retention, and addresses integration concerns and lessons learned is provided.

Author

N91-11360*# Canadian Forces Base Cold Lake, Medley (Alberta).

A CANADIAN FEMALE CF-18 PILOT'S EXPERIENCE

DEANNA MARIE BRASSEUR *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 5 p Aug. 1990

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Educational experiences, early military career, flight training, advanced jet aircraft training, experience as a flight instructor, fighter aircraft training, and operational fighter squadron experience of a Canadian female CF-18 pilot are summarized.

Author

**N91-11361# Royal Netherlands Air Force, Soesterberg.
THE SELECTION, TRAINING, AND OPERATIONAL WORK OF
FEMALE HELICOPTER PILOTS IN THE ROYAL
NETHERLANDS AIR FORCE**

MARIELLE WINNUBST *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 5 p Aug. 1990
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In 1976 it was decided in the Netherlands to allow women into almost all functions within the armed forces, which included flying. Being one of the few female helicopter pilots of the 298 squadron for two years now, some of the practical problems female helicopter pilots in the R.N.L.A.F. were (and still are) faced with, are highlighted. Presently there are only 9 female helicopter pilots in the Netherlands Air Force; one female transport aircraft pilot; and one female jet aircraft pilot. Being unfamiliar with the last two categories, the experiences of myself, 8 female colleagues and the few predecessors are the focus of interest. Because of the low numbers, this is a highly personal account. Author

N91-11362# Air Force Human Resources Lab., Brooks AFB, TX.

**COMPARISON OF MALE AND FEMALE USAF PILOT
CANDIDATES**

FREDERICK M. SIEM and LINDA L. SAWIN *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 7 p Aug. 1990

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Female Air Force pilot candidates were compared to male candidates in terms of factors related to pilot training performance. The factors examined included selection test scores, background measures such as college academic performance and major, and ratings from a college military training program. Successful candidates of both sexes, compared to less successful candidates, had higher ratings and test scores, and also a higher percentage of technical majors and licensed private pilots. The data were analyzed for predictive equity or whether the utility of the factors for prediction of flying training outcomes differed for females and males. The results of regression analyses indicated that the factors examined were equally useful for candidates of both sexes.

Author

N91-11363# Naval Aerospace Medical Research Lab., Pensacola, FL.

**NAVAL AVIATION SELECTION TEST SCORES AND FEMALE
AVIATOR PERFORMANCE**

DAVID J. BLOWER, DANIEL L. DOLGIN, and RONALD N. SHULL *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 5 p Aug. 1990

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The majority of U.S. Navy pilots are white males. Of the 12,477 Navy pilots, only 225 (1.8 percent) are women. Navy women are prohibited from permanent assignment on ships or aircraft designated for potential combat missions. Data comparing female and male performance on aviation selection tests over the past five years is present. Female and male student naval aviator performance in primary flight training and on a cognitive/psychomotor test battery are compared. The data examined uncovered some differences in aviation selection test scores as well as differences in cognitive/psychomotor performance, but corresponding effect of these variables on success in primary flight training was discovered.

Author

N91-11364# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Hamburg (Germany, F.R.). Dept. of Aviation and Space Psychology.

**SEX DIFFERENCES CONCERNING PERFORMANCE AND
PERSONALITY TRAITS OF APPLICANTS FOR HIGHLY
QUALIFIED OPERATOR FUNCTIONS IN AVIATION**

KLAUS-MARTIN GOETERS and HINNERK EISSFELDT *In* AGARD, Recruiting, Selection, Training and Military Operations of

Female Aircrew 6 p Aug. 1990

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Today, in the West German civil aviation females apply for training as pilots as well as air traffic controllers. Female pilot applicants are still a minority of less than 10 percent. Representative data only exists in the area of air traffic control (ATC) where about 30 to 40 percent of all applicants are female. In the psychological selection of applicants for ATC training the rate of acceptance is significantly smaller for females than for males. Therefore sex differences were investigated in cognitive aptitudes as well as in aspects of personality. The results revealed clear deficiencies for the majority of female applicants in two basic operational aptitudes: spatial orientation and technical comprehension. A lower performance of females was also revealed with regard to mathematical reasoning. Advantages of the female group with respect to other aptitudes (English and perceptual speed) were found to be relatively small. Sex differences in personality were observed for aspects of emotionality, activity, and interpersonal behavior. Females scored higher in scales of emotional instability, empathy, and achievement motivation, but lower in scales of vitality and dominance.

Author

N91-11365# Institute of Aviation Medicine, Oslo (Norway).

**PSYCHOLOGICAL AND SOCIOLOGICAL ASPECTS OF THE
ENTRANCE OF FEMALE AIRCREW TO THE NORWEGIAN
AIRFORCE**

G. MYHRE, B. OVESEN, and M. MARTINUSSEN (Norwegian Defence Psychological and Educational Center, Oslo.) *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 5 p Aug. 1990

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The total number of applicants for pilot screening and officer school in the Royal Norwegian Air Force (RNoAF) from 1982 to 1989 were studied in order to reveal the fate of female applicants during these years and establish if the females accepted represented a fairly constant percentage of the total number of applicants. The results from the psychological tests for 17 female applicants admitted to pilot screening and officer school were compared with those of the 173 accepted male applicants. A survey was performed in the RNoAF, in order to map the attitudes of squadron commanders and flight commanders (34 males) about their professional experience with the present female air crew in the RNoAF. In addition the females (5) answered questions regarding how they experience their situation seen from a female point of view. The results are briefly summarized.

Author

N91-11366# Centro de Instruccion de Medicina Aeroespacial, Madrid (Spain).

**EVALUATION OF FEMALE AND MALE AIRCREW
APPLICANTS USING A COGNITIVE AND PSYCHOMOTOR
TEST**

MARQUEZ DELAPLATA *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 3 p Aug. 1990

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The Spanish Institute of Aviation Medicine (CIMA) has developed a system and the equipment for the assessment of performance of complex tasks, which will be used for the evaluation of candidates cognitive and psychomotor abilities in order to become a pilot. This system also permits the investigator to evaluate the learning capability of an individual in those tasks. The equipment consists of the following: modules for the programming and emission of visual and auditory stimuli; desks with devices for transmission of stimuli (visor and headsets) and responses (two buttons and two pedals); and modules for the recording, counting, and timing of responses. The procedure requires that the subject has to give a response to the programmed stimuli according to a previous criterion established after the significant physical features of each stimulus, which were previously divided into four categories. This test was administered to a sample of 135 subjects, 115 males and 20 females; they were applicants

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for a commercial pilot license. The age ranged from 17 to 25 years, and nobody had any previous piloting experience. The goal of the experiment was focused on testing whether there were significant differences between men and women in the cognitive-psychomotor task assigned. In other words if the factor sex influences on the performance (R) and on the average time of response (T), considering as a null hypothesis that there are no significant statistical differences between the group of males and the group of females. The statistical analysis of the results obtained from each subject in both trials was oriented to verify the null hypothesis. The statistical analysis shows that the results obtained in the pilot applicants in the cognitive-psychomotor test proposed were not significantly different in men compared to women.

Author

N91-11367# Defence and Civil Inst. of Environmental Medicine, North York (Ontario). Central Medical Board.

FEMALE AIRCREW: THE CANADIAN FORCES EXPERIENCE

R. J. HICKS /n AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 6 p Aug. 1990

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Data collected since females first started aircrew training in Canada in 1979 is reviewed. Females are less successful than males in selective competition for training, but once into the training scheme there is no significant sex difference in achieving wings standard. Although numbers are still relatively small, female aircrew are now participating equally with their male peers in all aspects of military flying including tactical fighter operations.

Author

N91-11368# Belgian Air Force, Brussels.

REVIEW OF FEMALE APPLICANT AIRCREW IN THE BELGIAN FORCES

C. VANCUTSEM and P. VANDENBOSCH /n AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 5 p Aug. 1990 In FINNISH; ENGLISH summary

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The female applicant pilots in the Belgian Armed Forces were evaluated. In the period from January 1983 to July 1989, seventy-three female applicants were examined in the Centre of Aerospace Medicine. Only five of them were declared physically fit as a pilot, but no one could start the instruction. The physical reasons of rejection are studied according to the frequency in the total population, and ranked in accordance with the different criteria and the category of recruitment. A comparison is made between male and female applicants. The most frequent causes of rejection are: insufficient psychomotoric score, myopia, and too short legs.

Author

N91-11380*# Georgia Inst. of Tech., Atlanta. Center for Human-Machine Systems Research.

OPERATOR FUNCTION MODELING: COGNITIVE TASK ANALYSIS, MODELING AND INTELLIGENT AIDING IN SUPERVISORY CONTROL SYSTEMS Final Report

CHRISTINE M. MITCHELL Sep. 1990 67 p

(Contract NAG2-413)

(NASA-CR-187331; NAS 1.26:187331) Avail: NTIS HC/MF A04 CSCL 051

The design, implementation, and empirical evaluation of task-analytic models and intelligent aids for operators in the control of complex dynamic systems, specifically aerospace systems, are studied. Three related activities are included: (1) the models of operator decision making in complex and predominantly automated space systems were used and developed; (2) the Operator Function Model (OFM) was used to represent operator activities; and (3) Operator Function Model Expert System (OFMspert), a stand-alone knowledge-based system was developed, that interacts with a human operator in a manner similar to a human assistant in the control of aerospace systems. OFMspert is an architecture for an operator's assistant that uses the OFM as its system and operator knowledge base and a blackboard paradigm of problem solving to dynamically generate expectations about upcoming operator

activities and interpreting actual operator actions. An experiment validated the OFMspert's intent inferencing capability and showed that it inferred the intentions of operators in ways comparable to both a human expert and operators themselves. OFMspert was also augmented with control capabilities. An interface allowed the operator to interact with OFMspert, delegating as much or as little control responsibility as the operator chose. With its design based on the OFM, OFMspert's control capabilities were available at multiple levels of abstraction and allowed the operator a great deal of discretion over the amount and level of delegated control. An experiment showed that overall system performance was comparable for teams consisting of two human operators versus a human operator and OFMspert team.

Author

N91-11381# European Space Agency, Paris (France).

DETERMINANTS OF DUAL-TASK INTERFERENCE AND RESOURCE THEORIES IN COGNITIVE PSYCHOLOGY

DIETRICH MANZEY Aug. 1990 238 p Transl. into ENGLISH of Determinanten der Aufgabeninterferenz bei Doppeltaetigkeiten und Ressourcentheoretische Modellvorstellungen in der Kognitiven Psychologie (Hamburg, Fed. Republic of Germany, DFVLR), Feb. 1988 234 p Original language document was announced as N88-27748

(ESA-TT-1127; DFVLR-FB-88-14; ETN-90-98000) Avail: NTIS HC/MF A11

As a rule, an attempt to perform two tasks simultaneously will lead to performance loss in at least one of the two. In two experiments (22 subjects), the determinants of these interference effects were investigated by analyzing Performance Operating Characteristic (POC) curves for various task combinations. It was shown that the level of task interference in dual-task is primarily influenced by the similarity between the two tasks with regard to their perceptive-cognitive and response-related demands and that the degree of task difficulty is of subordinate importance. The results are interpreted as proof of the prognostic value of the theory of multiple resources.

ESA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A91-10026*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

A REVIEW OF THE HABITABILITY ASPECTS OF PRIOR SPACE FLIGHTS FROM THE FLIGHT CREW PERSPECTIVE WITH AN ORIENTATION TOWARD DESIGNING SPACE STATION FREEDOM

J. H. STRAMLER (NASA, Johnson Space Center; Barrios Technology, Inc., Houston, TX) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 9 p. refs

(AIAA PAPER 90-3567)

Habitability is a very important issue in long-duration spaceflight. With this concern, a review of much of the existing U.S. Skylab, Spacelab, and some Soviet literature on habitability aspects of long-duration space flight was completed for the Astronaut Space Station Support Office. The data were organized to follow as closely as possible the SSF distributed systems, such as Life Support, Data Management, etc. A new definition of habitability is proposed.

Author

A91-10027#

MAN VERSUS MACHINE IN SPACE OPERATIONS

JEAN M. ROUBERTIE (AMDBA, S.A., Saint-Cloud, France) AIAA, Space Programs and Technologies Conference, Huntsville, AL,

Sept. 25-27, 1990. 7 p.

(AIAA PAPER 90-3569) Copyright

The problem of manned versus unmanned advanced exploration of space is examined with particular reference to European manned space flight programs. The usefulness of human crews in space is assessed, and the cooperation between man and machine is defined. It is proposed that the advantages of having a crew on board be evaluated, case by case, in terms of cost-effectiveness, and ground simulations carried out to validate the hypotheses. In the few cases where the evaluation concludes that a crew is necessary, the use of the crew should be optimized by some means of assistance, such as robotics and artificial intelligence.

V.L.

A91-10028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

INSIGHT TO HUMAN AND ROBOTIC PARALLELS IN SPACECRAFT AND SPACE TOOL DESIGN

RUTHAN LEWIS (NASA, Goddard Space Flight Center, Greenbelt, MD) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 6 p. refs

(AIAA PAPER 90-3570) Copyright

The parallels between human space activity and robotics and the role of their compatibility in the design of critical spacecraft elements are discussed with reference to current manned spacecraft programs, such as the Shuttle and Space Station Freedom. In particular, it is noted that the human variable may be the limiting factor with regards to repetition, fatigue, and possibly strength. This limiting factor serves as the natural constraint in the design of compatible interfaces. However, the mechanism or tool, not the capability of the robot, is constrained to human limits. Results of a limited test to study the robotic compatibility of the EVA-suitable connectors are reported.

V.L.

A91-10072*# NASA Space Station Program Office, Reston, VA. SPACE STATION FREEDOM ON-ORBIT CREW TIME

AVAILABILITY - A LIMITED RESOURCE

JERRY J. GAREGNANI (NASA, Space Operations Div., Reston, VA) and MICHELLE C. ALLEN (Booz-Allen and Hamilton, Inc., Bethesda, MD) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 10 p.

(Contract NASW-4300)

(AIAA PAPER 90-3653) Copyright

Because of the enormity, complexity, and duration of the Space Station Freedom (SSF) project, the available crew time is at a premium. This paper discusses the methodology for determining, early in the program, estimates of crew time which will be available within pressurized areas of intravehicular activity, from the First Element Launch (FEL) throughout the lifetime of the SSF. The methodology utilizes the baseline assembly sequence (November 1989) as a guideline. The total hours provided are categorized by periods, where a period is comprised of the time between two major SSF Program assembly milestones; e.g., FEL to Man Tended Capability (MTS), MTS to Permanently Manned Capability (PMC), or PMC to Assembly Complete (AC). After AC, total available crew time is presented on a yearly basis.

I.S.

A91-10089*# EVA/TELEROBOTIC COOPERATION FOR AEROBRAKE ASSEMBLY

DAVID E. ANDERSON and LISA M. ROCKOFF (McDonnell Douglas Space Systems Co., Huntington Beach, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 11 p. refs

(AIAA PAPER 90-3678) Copyright

This paper describes the newly developed EVA/telerobotic cooperation aerobrake assembly techniques as well as neutral-buoyancy tests of an aerobrake concept combining EVA crew members and telerobots. The results of these tests indicate that such operations are feasible. The successful application of combined EVA and telerobotics to the aerobrake tasks will be applicable to other Space Station evolution tasks such as the large deployable reflector assembly, on-orbit engine refurbishment,

and general maintenance of the station. Special attention is given to the safety issues for EVA crewmembers working near the telerobot when it is not under direct human control and to the interaction between the EVA crew members and the telerobot control computer.

I.S.

A91-10101#

FLIGHT TELEROBOTIC SERVICER PROGRAM OVERVIEW

D. C. HALEY (Martin Marietta Space Systems Co., Denver, CO) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 3 p.

(AIAA PAPER 90-3702) Copyright

The paper presents a brief overview of the Flight Telerobotic Servicer (FTS) program. Two test flights precede deployment of the operational FTS on a first-element launch of the Space Station Freedom (SSF). Major components of the FTS system include the telerobot, workstations for operation from the shuttle and SSF, and an on-orbit storage facility. Versatility is enhanced by the ability of the FTS to operate from improved worksites which provide all utilities, from the SSF transport systems, and from unimproved worksites using battery power and Ku-band communication.

Author

A91-10102#

AUTOMATION AND ROBOTICS TECHNOLOGIES FOR THE MOBILE SERVICING SYSTEM

R. RAVINDRAN, S. S. SACHDEV (Spar Aerospace, Ltd., Toronto, Canada), and D. HUNTER (Canadian Space Agency, Ottawa, Canada) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 11 p.

(AIAA PAPER 90-3703) Copyright

The current status of a program aimed at the development of advanced technologies applicable to the Mobile Servicing System (MSS) is reviewed. The MSS features a large manipulator, the Space Station Remote Manipulator System, and a smaller robotic system, the Special Purpose Dextrous Manipulator. The control system of both manipulators is described, and some advanced automation and robotic technologies being developed for incorporation into the system are discussed. These include advanced vision, an advanced information system, collision control, robotic languages, and expert systems. A robotic ground testbed to be used for developing these technologies is described.

V.L.

A91-10103#

AUTOMATION AND ROBOTIC ACTIVITIES IN WP-2

RICK G. NORNHOLM and STEVEN D. FLEISCHAKER (McDonnell Douglas Space Systems Co., Huntington Beach, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 9 p.

(AIAA PAPER 90-3704) Copyright

The status of the automation and robotics activities in the Space Station Freedom program's Work Package Two (WP-2) is briefly reviewed. The discussion covers the development of the EVA-Robotic Design Standards document and the Robotic ORU Assembly and Maintenance methodology, robotic simulation efforts, testing and verification of the robot compatibility of hardware, flight Telerobotic Service integration with Space Station hardware, and the Robot Friendly Working Group.

V.L.

A91-10104#

AUTONOMOUS CONTROL FOR SPACE STATION FREEDOM IVA OPERATIONS

R. B. PURVES, W. S. DAVIS, and J. R. CARNES (Boeing Co., Huntsville, AL) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 5 p. refs

(AIAA PAPER 90-3705) Copyright

Research and development activities aimed at increasing the efficiency of Space Station Freedom intravehicular operations through the use of automation and robotics technologies are reviewed. The approaches considered include: (1) the development of the capability to autonomously generate and validate operations plans for an array of agents, including robots, crew members, and software simulations; and (2) evaluation of the performance of

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these plans in a testbed using intelligent simulation, sensor integration, and automated diagnostic techniques to ensure the safe and consistent execution of the program. V.L.

A91-10115* National Aeronautics and Space Administration, Washington, DC.

ADVANCED LIFE SUPPORT TECHNOLOGY DEVELOPMENT FOR THE SPACE EXPLORATION INITIATIVE

PEGGY L. EVANICH (NASA, Washington, DC), GÉRALD E. VOECKS, and P. K. SESHAN (JPL, Pasadena, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 12 p.

(AIAA PAPER 90-3726) Copyright

An overview is presented of NASA's advanced life support technology development strategy for the Space Exploration Initiative. Three basic life support technology areas are discussed in detail: air revitalization, water reclamation, and solid waste management. It is projected that regenerative life support systems will become increasingly more complex as system closure is maximized. Advanced life support technology development will utilize three complementary elements, including the Research and Technology Program, the Regenerative Life Support Program, and the Technology Testbed Validations. L.K.S.

A91-10116* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, AL.

ECLSS DEVELOPMENT FOR FUTURE SPACE MISSIONS

PAUL O. WIELAND and WILLIAM R. HUMPHRIES (NASA, Marshall Space Flight Center, Huntsville, AL) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 10 p. refs

(AIAA PAPER 90-3728) Copyright

The Environmental Control and Life Support System (ECLSS) for Space Station Freedom is presently under development. Three areas of concern for longer duration missions are recycling of mass, monitoring and controlling the ECLSS, and controlling trace contaminants and microorganisms. The goal is to 'close the loop' for water and oxygen much more than has been done on previous missions. Alternative technologies for performing each of the ECLSS functions are being developed and evaluated as part of the selection process for choosing the technologies to use on Freedom. Methods to automatically monitor and control the ECLSS are being investigated. The instrumentation needs are being determined in order to focus effort where most needed. Research is also underway to improve methods of monitoring and controlling trace contaminants and microorganisms. Author

A91-10117* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

THE PHYSICAL/CHEMICAL CLOSED-LOOP LIFE SUPPORT RESEARCH PROJECT

VINCENT J. BILARDO, JR. (NASA, Ames Research Center, Moffett Field, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 15 p. refs

(AIAA PAPER 90-3729) Copyright

The various elements of the Physical/Chemical Closed-Loop Life Support Research Project (P/C CLLS) are described including both those currently funded and those planned for implementation at ARC and other participating NASA field centers. The plan addresses the entire range of regenerative life support for Space Exploration Initiative mission needs, and focuses initially on achieving technology readiness for the Initial Lunar Outpost by 1995-97. Project elements include water reclamation, air revitalization, solid waste management, thermal and systems control, and systems integration. Current analysis estimates that each occupant of a space habitat will require a total of 32 kg/day of supplies to live and operate comfortably, while an ideal P/C CLLS system capable of 100 percent reclamation of air and water, but excluding recycling of solid wastes or foods, will reduce this requirement to 3.4 kg/day. L.K.S.

A91-10118* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

THE CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) RESEARCH PROGRAM

ROBERT D. MACELROY (NASA, Ames Research Center, Moffett Field, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 12 p. refs

(AIAA PAPER 90-3730) Copyright

The goal of the Controlled Ecological Life Support Systems (CELSS) program is to develop systems composed of biological, chemical and physical components for purposes of human life support in space. The research activities supported by the program are diverse, but are focused on the growth of higher plants, food and waste processing, and systems control. Current concepts associated with the development and operation of a bioregenerative life support system will be discussed in this paper. Author

A91-10120* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

SPACE SUITS AND LIFE SUPPORT SYSTEMS FOR THE EXPLORATION OF MARS

LAWRENCE H. KUZNETZ (NASA, Ames Research Center, Moffett Field, CA) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 13 p. refs

(AIAA PAPER 90-3732) Copyright

The requirements and technologies needed for a viable space suit, or Extravehicular Mobility Unit (EMU), to be worn under conditions of Martian gravity field and environment are examined and alternative concepts for space suits and portable life support systems for the exploration of Mars are proposed. The challenge is illustrated by a comparison of the Martian surface with previous and current manned space environments, such as the low earth orbit, the lunar surface, and the surface of the earth. A summary of relevant data collected from Mariner and Viking probes is presented and it is pointed out that this information must be used to create an EMU which provides temperature regulation; humidity control; a regulated oxygen supply; pressure regulation; metabolic and toxic waste removal; contaminant control; thermal and cosmic radiation protection; biological isolation of the human and the Mars environment from each other; tear, dust, and puncture protection; water; and communication. L.K.S.

A91-10122* National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

APPROACHES TO LUNAR BASE LIFE SUPPORT

M. F. BROWN and M. A. EDEEN (NASA, Johnson Space Center, Houston, TX) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 7 p.

(AIAA PAPER 90-3740) Copyright

Various approaches to reliable, low maintenance, low resupply regenerative long-term life support for lunar base application are discussed. The first approach utilizes Space Station Freedom physiochemical systems technology which has closed air and water loops with approximately 99 and 90 percent closure respectively, with minor subsystem changes to the SSF baseline improving the level of water resupply for the water loop. A second approach would be a physiochemical system, including a solid waste processing system and improved air and water loop closure, which would require only food and nitrogen for resupply. A hybrid biological/physiochemical life support system constitutes the third alternative, incorporating some level of food production via plant growth into the life support system. The approaches are described in terms of mass, power, and resupply requirements; and the potential evolution of a small, initial outpost to a large, self-sustaining base is discussed. L.K.S.

A91-10159*

ADVANCED EXTRAVEHICULAR ACTIVITY REQUIREMENTS IN SUPPORT OF THE MANNED MARS MISSION

WILLIAM R. POGUE, GERALD P. CARR (CAMUS, Inc., Huntsville, AL), and NICHOLAS SHIELDS, JR. (RECCEN Corp., Huntsville, AL) AIAA, Space Programs and Technologies Conference,

Huntsville, AL, Sept. 25-27, 1990. 8 p. refs
(AIAA PAPER 90-3801) Copyright

The support requirements for an extended human exploration of the Martian surface by a crew of eight are examined. Emphasis is given to EVA activities at the base camp and to extended EVA and the environmental conditions impacting on the latter. The roles of hardware and machine system requirements in EVA are addressed.

C.D.

**A91-10214#
A SPACE SUIT FOR LUNAR CONSTRUCTION AND EXPLORATION**

BRAND NORMAN GRIFFIN (Boeing Co., Huntsville, AL) AIAA, Space Programs and Technologies Conference, Huntsville, AL, Sept. 25-27, 1990. 8 p. refs
(AIAA PAPER 90-3885) Copyright

This paper describes the Command/Control Pressure Suit (CCPS) designed for the lunar exploration and construction. The CCPS will operate in a vacuum and will have to be resistant to the pervasive and abrasive dust. It is designed to operate both in weightless environment and in a gravity field. The key features of the CCPS are discussed, which include internal displays, the integral torso/helmet assembly, the single-point entry, and modularity. Diagrams of the CCPS illustrating these features are presented.

I.S.

A91-10913*# National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.

SPACE STATION LOCATION CODING THAT MAKES SENSE
LEONG W. LEW (NASA, Johnson Space Center, Houston, TX) and WILLIAM J. PRAUS (Johnson Engineering Corp., Houston, TX) IN: Space Logistics Symposium, 3rd, Colorado Springs, CO, Apr. 30-May 2, 1990, Proceedings. Huntsville, AL, Society of Logistics Engineers, 1990, 9 p.

An alphanumeric interior and exterior location coding system for elements of the Space Station is presented as an aid in identifying specific locations aboard the Station and possibly in locating specific items of loose equipment stowed in these locations. Past experience with long-duration missions has demonstrated the difficulty of tracking loose equipment aboard spacecraft. Inasmuch as over 50,000 items of loose equipment must be accounted for aboard Space Station Freedom there is a high potential for continuing difficulties in this area. It is shown that the alphanumeric location coding system described is simple, logical, and easy to use.

R.E.P.

A91-12594* National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, CA.

CREW SUPPORT FOR AN INITIAL MARS EXPEDITION
YVONNE A. CLEARWATER (NASA, Ames Research Center, Moffett Field, CA) and ALBERT A. HARRISON (California, University, Davis) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 43, Nov. 1990, p. 513-518. refs
Copyright

Mars crews will undergo prolonged periods of isolation and confinement, travel unprecedented distances from earth and be subjected to formidable combinations of hardships and dangers. Some of the biomedical, psychological and social challenges of the first manned Mars expedition are reviewed and means of aligning humans, technology and space habitats in the interests of mission success are identified.

Author

**A91-12646
END-POINT CONTROL OF A FLEXIBLE ARM KEEPING A CONSTANT DISTANCE TO FLUCTUATING TARGET**

S. CHONAN (Tohoku University, Sendai, Japan) and S. AOSHIMA (Fuji Photo Film Co., Ltd, Tokyo, Japan) Journal of Sound and Vibration (ISSN 0022-460X), vol. 142, Oct. 8, 1990, p. 87-100. refs
Copyright

In this paper a theoretical and experimental study is presented on the control of a single-link flexible arm, the tip of which keeps a constant distance from the fluctuating surface of the target.

The relative displacement between the arm and the target is measured by a gap sensor mounted on the tip of the arm. It is then used, together with the estimated relative velocity, as the basis for applying control torque to the other end of the arm. It is shown both theoretically and experimentally that the PD control using the end-point sensing and base torquing is sufficient to make the flexible arm follow the fluctuation of the target. Author

N91-10596# Technische Univ., Delft (Netherlands).

TECHNIQUE FOR HUMAN-ERROR SEQUENCE IDENTIFICATION AND SIGNIFICATION Ph.D. Thesis

GERBEN HESLINGA 1988 161 p Submitted for publication Sponsored by Dutch Electricity Supply Companies, Arnhem, Netherlands
(ISBN-90-353-10144; ETN-90-97757) Avail: NTIS HC/MF A08

The human factor influence on the safety of complex installations was addressed. An event tree technique was adapted to the study: Technique for Human Error Sequence Identification and Signification (THESIS). The THESIS event trees, appear to present problems if they are applied to human performance instead of technical systems. These problems, referred to as the 'man-related features' of THESIS, are: the human capability to choose among several procedures, the ergonomics of the panel layout, human actions of a continuous nature, dependence between human errors, human capability to recover possible errors, the influence of memory during the recovery attempt, variability in human performance and correlations between human error probabilities. The influence of these problems on the applicability of THESIS was assessed by means of mathematical analyses, field studies and laboratory experiments. The main conclusion is that, with certain limitations, event trees can be used to predict sequences of human errors if procedural actions are performed.

ESA

N91-10597# Universiteit Twente, Enschede (Netherlands).

MODELS OF THE HUMAN OBSERVER AND CONTROLLER OF A DYNAMIC SYSTEM Ph.D. Thesis

PAULUS HEINRICH WEWERINKE 1989 205 p
(ETN-90-97759) Avail: NTIS HC/MF A10

Human functioning and its interaction with a dynamic system are studied. The total Man-Machine System (MMS) is described in precise terms resulting in mathematical models. By comparing model results with results of experiments, the correspondence of the models with reality is investigated. Models relating to the human observer and controller, human regulator control, visual scene perception and the human observer and decision maker are described. Detailed conclusions and recommendations for future work are given.

ESA

N91-10943*# Miami Univ., Coral Gables, FL.

HUMAN FACTORS OF THE HIGH TECHNOLOGY COCKPIT
EARL L. WIENER In NASA, Langley Research Center, Aviation Safety/Automation Program Conference p 83-90 Oct. 1990
Avail: NTIS HC/MF A12 CSCL 05H

The rapid advance of cockpit automation in the last decade has outstripped the ability of the human factors profession to understand the changes in human functions required. High technology cockpits require less physical (observable) workload, but are highly demanding of cognitive functions such as planning, alternative selection, and monitoring. Furthermore, automation creates opportunity for new and more serious forms of human error, and many pilots are concerned about the possibility of complacency affecting their performance. On the positive side, the equipment works as advertised with high reliability, offering highly efficient, computer-based flight. These findings from the cockpit studies probably apply equally to other industries, such as nuclear power production, other modes of transportation, medicine, and manufacturing, all of which traditionally have looked to aviation for technological leadership. The challenge to the human factors profession is to aid designers, operators, and training departments in exploiting the positive side of automation, while seeking solutions to the negative side. Viewgraphs are given.

Author

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

N91-10944*# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, CA.

HUMAN-CENTERED AUTOMATION: DEVELOPMENT OF A PHILOSOPHY

CURTIS GRAEBER and CHARLES E. BILLINGS *In* NASA, Langley Research Center, Aviation Safety/Automation Program Conference p 91-104 Oct. 1990

Avail: NTIS HC/MF A12 CSCL 05H

Information on human-centered automation philosophy is given in outline/viewgraph form. It is asserted that automation of aircraft control will continue in the future, but that automation should supplement, not supplant the human management and control function in civil air transport. Author

N91-10945*# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, CA.

CREW WORKLOAD STRATEGIES IN ADVANCED COCKPITS

SANDRA G. HART *In* NASA, Langley Research Center, Aviation Safety/Automation Program Conference p 105-125 Oct. 1990

Avail: NTIS HC/MF A12 CSCL 05H

Many methods of measuring and predicting operator workload have been developed that provide useful information in the design, evaluation, and operation of complex systems and which aid in developing models of human attention and performance. However, the relationships between such measures, imposed task demands, and measures of performance remain complex and even contradictory. It appears that we have ignored an important factor: people do not passively translate task demands into performance. Rather, they actively manage their time, resources, and effort to achieve an acceptable level of performance while maintaining a comfortable level of workload. While such adaptive, creative, and strategic behaviors are the primary reason that human operators remain an essential component of all advanced man-machine systems, they also result in individual differences in the way people respond to the same task demands and inconsistent relationships among measures. Finally, we are able to measure workload and performance, but interpreting such measures remains difficult; it is still not clear how much workload is too much or too little nor the consequences of suboptimal workload on system performance and the mental, physical, and emotional well-being of the human operators. The rationale and philosophy of a program of research developed to address these issues will be reviewed and contrasted to traditional methods of defining, measuring, and predicting human operator workload. Viewgraphs are given. Author

N91-11369# Defence and Civil Inst. of Environmental Medicine,
North York (Ontario).

AIRCREW/COCKPIT COMPATIBILITY: A MULTIVARIATE PROBLEM SEEKING A MULTIVARIATE SOLUTION

KEITH C. HENDY *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 8 p Aug. 1990

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Aircrew/cockpit compatibility depends on an interaction between the anthropometry of individual aircrew members and the geometry of the cockpit. Selection criteria in the past have attempted to deal with this interaction, but the model was too simple. This is a multi-variate problem which requires a multi-variate solution. Essentially the problem is one of charging the region of intersection between the anthropometric data domain and a set of rules or criteria which define operability. The nature of this problem was demonstrated through computer simulated fitting trials of subjects in a number of cockpit-like geometries. The simulations clearly demonstrate that membership in a particular category of fit depends on interactions between workspace and anthropometry which are geometry specific. Further, the simulations show that the establishment of analytical expressions to define class membership is complex and appears to require a nonlinear approach. The consequences of these results are discussed in terms of establishing selection standards and determining design criteria for cockpits which are compatible with these standards. It is argued that cockpit design must be based on an extensive

sampling of human characteristics in order that the full range of interactions, between various anthropometric dimensions and the workspace, is represented. Author

N91-11371# Defence and Civil Inst. of Environmental Medicine,
North York (Ontario).

ANTHROPOMETRIC ACCOMMODATION OF FEMALES IN CANADIAN FORCES AIRCRAFT CREW STATIONS

P. L. ROTHWELL and R. A. PIGEAU *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 13 p Aug. 1990

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To ensure physical accommodation of humans in aircraft crew stations, aircrew traditionally were selected on the basis of specific standards. To be effective, these standards must be based on anthropometric limitations imposed by actual crew stations. Evidence suggests this generally is not the case. Instead, selection standards have frequently evolved from (1) aircraft design recommendations, which often bear little relationship to the finished product, or (2) anthropometry of existing aircrew, which ignores the issue. Recognizing this problem, the Canadian Forces (CF) has undertaken a large-scale study known as ACCE (Aircrew/Cockpit Compatibility Evaluation). A computer-based modelling strategy was developed to determine anthropometric limitations, on a crew station by crew station basis, and their subsequent effect on accommodation of pilot and navigator populations. The approach is attractive because it encompasses possible multivariate relationships between anthropometry and crew station geometries, and it is sub-population independent; it assumes a human anthropometry but is blind to gender, nationality, and race-specific differences. The flexibility of this strategy has allowed assessments of fit for both female and male populations in two CF aircraft - the CT133 utility jet and the CH136 light observation helicopter. Results show that current CF selection standards do not represent the range of anthropometry these aircraft can accommodate. This leads to biases in selection against females and small males. Author

N91-11372# Laboratoire de Medecine Aerospatiale,
Bretigny-sur-Orge (France).

PROBLEMS POSED BY THE ADAPTATION OF PHYSIOLOGICAL PROTECTIVE EQUIPMENT FOR FEMALE COMBAT PILOTS [PROBLEMES POSES PAR L'ADAPTATION DES EQUIPEMENTS DE PROTECTION PHYSIOLOGIQUE AUX PILOTES FEMININS D'AVIONS DE COMBAT]

D. LEJEUNE, J. C. AMICHAUD, A. TURILLON (Aerazur C.A., Issy-les-Moulineaux, France), J. M. CLERE, and H. MAROTTE *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 4 p Aug. 1990 In FRENCH; ENGLISH summary

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Female pilots would have to pilot fighter in the future. The problem of adaptation for flight equipment is induced by this new population of pilots. The specific female equipment functioning is studied from theoretical basis and from the literature. Operational solutions are presented for high G protection, thermal stress induced by C.W. flight equipment. Some questions are, today, without response and require further laboratory experiments. Author

N91-11373# Royal Air Force Inst. of Aviation Medicine,
Farnborough (England).

SOME EQUIPMENT PROBLEMS ASSOCIATED WITH THE INTRODUCTION OF FEMALE AIRCREW INTO THE ROYAL AIR FORCE

G. M. TURNER *In* AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 3 p Aug. 1990

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Female aircrew have been employed for several years as Air Loadmasters operating on VC10 transport aircraft. When it was

required that all transport aircrew be issued with nuclear, biological and chemical (NBC) protective equipment an anthropometry and sizing exercise was conducted with 21 randomly selected female loadmasters. The problems experienced are described and related to the anthropometry data. Mention is also made of the anticipated problems with the Royal Air Force's recent decision (1989) to train female pilots and navigators.

Author

N91-11374# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).

MORPHOLOGICAL AND FUNCTIONAL ADAPTATION OF PERSONAL EQUIPMENT DESIGNED FOR FEMALE PERSONNEL [ADAPTATION MORPHOLOGIQUE ET FONCTIONNELLE DES EQUIPEMENTS DE VOL DESTINES AUX PERSONNELS FEMININS]

H. MAROTTE, D. LEJEUNE, G. GUTMAN, R. BEAUSSANT, P. PELLOUX-GERVAIS, and R. ZAPATA (L'Air Liquide, Sassenage, France) *In AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 3 p Aug. 1990 In FRENCH; ENGLISH summary*

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Personal equipment is dedicated to protecting aircrews against adverse effects during flight. The equipment operates either in close loop or in open loop. In close loop situations, there is a control of the protective device in relation to the user's demand so that such equipment creates only a few problems. It is not so with open loop equipment. In this case, there is only a statistical relationship between functional characteristics of the equipment and the user's needs. It is especially difficult to adapt the equipment to females. As far as respiratory protection equipment is concerned, such problems were noticed in open loop equipment for technical aircrews and in closed circuit smoke-hoods for cabin attendants.

Author

N91-11375# Naval Air Development Center, Warminster, PA. Dept. of Air Vehicle and Crew Systems Technology.

ACCOMMODATION OF FEMALE AIRCREW IN USN PROTECTIVE FLIGHT CLOTHING AND EQUIPMENT

S. M. REEPS, H. T. PHEENY, and J. A. BRADY (Naval Aerospace Medical Research Lab., Pensacola, FL.) *In AGARD, Recruiting, Selection, Training and Military Operations of Female Aircrew 7 p Aug. 1990*

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The number of United States Navy aviation designated female personnel has increased substantially over the past two decades. Along with this increase has come the ever pressing requirement to provide these aircrew members with safe and effective protective clothing and life support equipment. A variety of problems which have arisen in attempting to accommodate the female aircrew in a clothing and equipment system which was designed for a male population are discussed. Although no overall integrated approach was employed in this effort, a review of the various methods and solutions which were successfully employed to address both the particular needs of individuals and the specific items of clothing and equipment are discussed. Based on a review of problem reports and personal contacts with currently designated female aircrew personnel, many problem areas remain. These areas are discussed as they will provide the basis for future work in this continuing effort.

Author

N91-11382# Lawrence Livermore National Lab., CA.

CHLORINE DIOXIDE AND HEMODIALYSIS

ROGER P. SMITH (Dartmouth Coll., Hanover, NH.) 1 May 1989

35 p

(Contract W-7405-ENG-48)

(DE90-015912; UCRL-CR-103401) Avail: NTIS HC/MF A03

Because it has little or no tendency to generate carcinogenic trichloromethanes such as chloroform, chlorine dioxide is an attractive alternative to chlorine for drinking water disinfection. There are, however, concerns about its acute toxicity, and the toxic effects of its by-products, chlorite and chlorate. The human experience

with chlorine dioxide in both controlled, prospective studies and in actual use situations in community water supplies have as yet failed to reveal adverse health effects. Among groups who may be at special risk from oxychlorines in drinking water are patients who must undergo chronic extracorporeal hemodialysis. Although even units for home hemodialysis are supposed to be equipped with devices which effectively remove oxychlorines, there is always a possibility of operator error or equipment failure. A hemodialysis and the effects of oxychlorine are discussed.

DOE

N91-11383# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.), Helicopter Div.

REQUIREMENTS OF AN HMS/D FOR A NIGHT-FLYING HELICOPTER

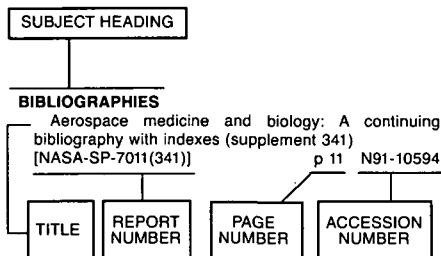
H.-D. BOEHM and R. SCHRANNER Apr. 1990 17 p Presented at SPIE'S Technical Symposium on Engineering and Photonics in Aerospace Sensing Conf. 1290 Helmet-Mounted Displays 2, Orlando, FL, 16-20 Apr. 1990 (MBB-UD-0570-90-PUB; ETN-90-97840) Avail: NTIS HC/MF A03

Requirements of a Helmet Mounted Sight (HMS/D) are studied. The development goal for the near future should be an integrated, lightweight helmet with a binocular display on the visor providing two or three sensor images. Operational requirements, human engineering aspects and the requirements of an integrated lightweight helmet with two Night Vision Goggle (NVG) tubes and two cathode ray tubes to display superimposed NVG and thermal imaging images with flight symbologies are described.

ESA

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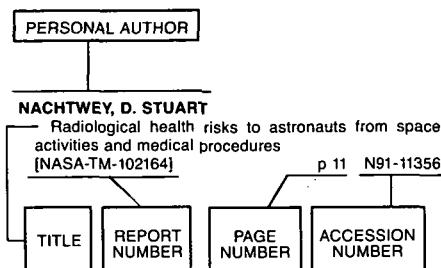
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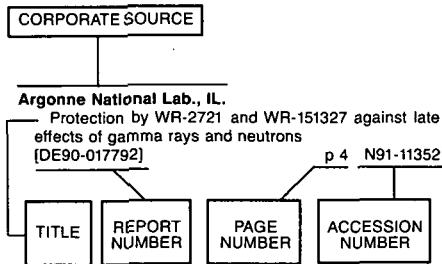
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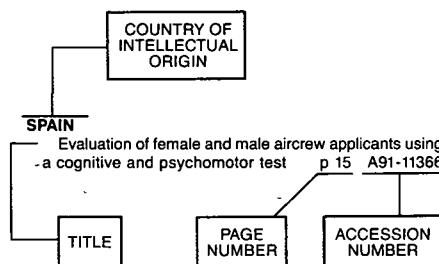
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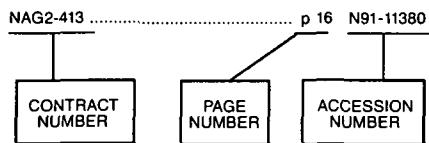
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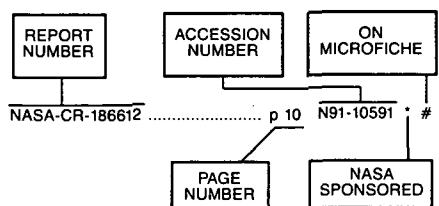
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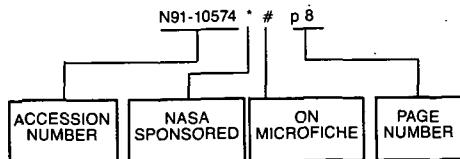
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